

What drives the value of art?

A quantitative study on the Swedish market for paintings

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Abstract

In 1989, Swedish writer Olof Lagercrantz sold “Fyrtornet II” by August Strindberg for 15.6 MSEK, a painting he had bought 11 years earlier for 70,000 SEK. This story is reminiscent of the public perception of the market for paintings, namely that art and high quality paintings in particular, are good investments. By using a previous dataset of 19,065 sales of paintings covering the period 1985 to 2006 and adding 6,902 transactions covering 2006 to 2016, we have created the largest dataset of Swedish auction prices for high quality oil paintings. This dataset has enabled us to create a Hedonic Price Index from which we have concluded that an investment in paintings has yielded an average return of 0.6% per year between 1985 to 2016. Additionally, using the methodology of Nasdaq indices with reinvested dividends, we have attempted to quantify something that has been identified within the subject field as the main source of discrepancy between share investments and investments in paintings, psychic returns: The pleasure one receives from consuming art. Our conclusion is that the only justifiable reason for investing in paintings is pure love of art.

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*“The purpose of art is washing the dust of daily life off our souls.”
-Pablo Picasso*

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1. Introduction

1.1 Why this topic is interesting

Record Prices

It is not uncommon to read about spectacular auction sales of paintings in the media. For example, in November of 2016 an abstract painting by Willem de Kooning was sold for the staggering amount of 600 MSEK.³ Likewise, in 2015 the famous painting “Women of Algiers (Version O)” by Pablo Picasso was sold for 1.5 BSEK at Christie’s in New York and became the most expensive painting ever sold at an auction. Although the Swedish art market is modest by international standards, every now and then record sales do occur. In 1989, Swedish writer Olof Lagercrantz sold “Fyrtornet II” by August Strindberg for 15.6 MSEK, a painting he had bought 11 years earlier for 70,000 SEK.⁴ The following year, “Underlandet”, also by Strindberg, broke the Swedish record when it was sold for 22.6 MSEK. Since the 1990s, the Swedish market for paintings had been quiet, until 2010 when “Sommarnöjet” by Anders Zorn broke the old record and was sold for 26 MSEK.⁵ As the media often highlights these record sales, it is not surprising that there exists a widespread belief that investments in art and paintings are highly profitable. In fact, in 1993 “Fyrtornet II” was on sale again for 4 MSEK and in 1992 “Underlandet” was bought for 3.8 MSEK.⁶ Thus the question is, how do investments in paintings perform over time, and how do their returns compare to market alternatives?

Extraordinary goods

In order to answer the questions above, one needs to overcome challenges of measuring returns on objects with unique characteristics. Paintings are extraordinary economic goods due to several reasons. Firstly, they are tremendously heterogeneous. Each painting is unique and prices may vary from literally one dollar to several hundred million. Secondly, living artists can affect the supply, thus the demand of their paintings by e.g. marketing. Lastly, in contrast to shares or other financial instruments, paintings and art do not generate the same recurring cash flows enabling traditional valuation methods based on sensible forecasts. How is one to value paintings as a prerequisite for an investment decision?

³ Article in Sydsvenskan, November 16th 2016

⁴ Article in Svenska Dagbladet, January 12th 2014

⁵ Article in Svenska Dagbladet, June 3rd 2010

⁶ Article in Dagens Nyheter, June 11th, 1993

Favorable market conditions

The interest in art markets is to some extent driven by current economic conditions. The global growth in the number of high-net-worth individuals during the past 10 years has been around 60%,⁷ and the subsequent increase in the need for diversification turns attention to art as an alternative investment. In addition, in a recently published survey on private bankers and wealth advisors, more than a third of the respondents reported that they expected an increase in wealth allocation towards collectibles such as art and that 78% (up from 55% in 2014) of wealth managers think that art and collectibles should be included as part of wealth management offerings.⁸ There are ever more favorable conditions speaking for an increase in interesting alternative investments such as art, and more specifically, paintings.

As in the case of most of the Western economies, the Swedish economy is currently undergoing a phase with historically low interest rates. In February 2015, for the first time in history, in an attempt to increase inflation, the Swedish Central Bank introduced an interest rate of -0.1%. Currently, the interest rate is -0.5% and expectations are that the low interest rates will continue well into 2018. Similarly to the art market boom in the late 1980s (discussed in Section 4.3.1 in detail), the combination of cheap capital and shortage of high yielding investment opportunities might make investors more interested in alternative investments. But should investors turn to the Swedish art market in hope of obtaining higher returns?

1.2 Gap in current research

No recent studies

Although there are no published studies that have been conducted on the Swedish art market, two master theses have been written at the Stockholm School of Economics. The first one by Ulf Hallius (1992) covers the period 1985 to 1991 and the second one by Emil Anderson and Henrik Björkman (2007) covers the period 1985 to 2006. Worth noting is that the second thesis by Anderson & Björkman (2007) built on the first one by Hallius (1992), and it is our intention to further build upon the groundwork laid by these two theses.

⁷ Knight Frank (2016)

⁸ Deloitte (2016)

Areas of interest

Based on painting transaction data, we will be running two regression analyses. These analyses will enable us to answer how key characteristics of paintings (size, artist, auction house, etc.) affect value, and allow us to construct an index which will help us assess the development of the market for Swedish high quality paintings.

Based on published international studies in addition to the Swedish theses, we have identified four interesting areas for our research. Firstly, we want to extend the dataset used by Anderson & Björkman (2007) with 10 more years of data on painting transactions up until 2016. The addition of transactions will both strengthen the regression model from a data perspective and enable us to view and analyze the returns on the Swedish market for high-quality paintings between the years 2006 to 2016, which has not been done previously.

Secondly, we want to expand the discussion around the construction and use of the so called Hedonic Price Index (“HPI”). The benefits of the HPI are integral for the purposes of valuing objects such as paintings, or any other objects which lack the traditional cash flow patterns more suitable for traditional valuation methods.

Thirdly, based on the data covering transactions between 2006 and 2016, we have identified additional value affecting characteristics such as height/width, date of creation and additional types of signatures. We intend to calculate the price effect of these additional characteristics and answer questions such as “what are the value effects of a portrait or landscape form painting?”. Neither height, width nor date of creation have been studied in a Swedish context previously. Additionally, we intend to isolate the value impact auction houses have on the prices of paintings. We also have access to estimated prices set by the auction houses which we will compare to the hammer prices. To our knowledge, this has also not been analyzed in a Swedish context.

Lastly, as mentioned, paintings are extraordinary goods. Similar to many other assets, the benefits accrued to owners are partly the monetary gains, partly the value of consuming the assets. Most previous research within the field have compared returns from investing in paintings with returns on investing in the stock market. The difference between has been identified as “psychic returns”, i.e. the consumption benefits of viewing or consuming art. We intend to go beyond the identification of psychic returns as a potential source of discrepancy by attempting to quantify

them over the period studied. Similarly to how Nasdaq calculates OMX gross indices by adding back dividends,⁹ we intend to add back hypothetical consumption income to our painting index.

1.3 Summary of findings

- The Swedish market for high-quality paintings has generated an average return of 0.6%¹⁰ per annum between the period 1985-2016. This can be seen in light of the average returns generated from investing in the stock market, which were 10.3% per annum over the same period. A big portion of the difference between the returns is due to the high transaction costs associated with investing in paintings.
- With the inclusion of psychic returns, an investment in paintings generated an impressive 8.1% yearly average return over the period 1985-2016. Again, this should be seen in light of an investment in the stock market with reinvested dividends which yielded a 16% average growth per year. The actual level of returns should be interpreted with caution. A conservative conclusion is that the level of psychic returns is very high in relation to pure price gains in the market for paintings.
- Prices of Swedish high-quality paintings increased dramatically in early 2007 before the financial crisis and declined as dramatically towards the end of the year. Art funds, a ghost of the 1980's market boom, came back to life during this short period of time.
- The number of paintings sold via traditional hammer auctions have decreased dramatically since the year 2000. We have identified a migration towards online auctions as a potential driver of this trend. According to representatives of the auction houses, online auctions warrant substantially higher prices and are more profitable.
- Compared to its closest competitor in terms of size and reputation, Stockholms Auktionsverk sold on average, paintings at a discount of 15% in relation to Bukowskis.
- Bukowskis had the highest turnover of 8,059 paintings sold in the period 1985-2016, closely followed by Stockholms Auktionsverk (6,414). The average was 1,119 paintings sold per auction house.
- Furthermore, Bukowskis also had the highest average price of 148,000 SEK per painting sold and Stockholms Auktionverk had an average of 90,000 SEK. The average of all individual auction house averages was 45,000 SEK.

⁹ Nasdaq OMX (2016)

¹⁰ When adjusting for transaction costs. Average returns are 1.8% per annum if transaction costs are excluded.

- Auction houses sold paintings for 20% higher than the original estimates¹¹ set by them. This indicates that auction houses systematically underestimate the prices of the paintings.
- Signed paintings sold on average at a 43% premium compared to paintings without any type of signature. Additionally, dated paintings sold at a premium of 26% compared to paintings without date of creation.
- The price premium on each increasing unit in height is 13% in relation to each increasing unit in width, implying that portrait format paintings warrant higher prices than landscape format paintings.

2. Theory

2.1 Literature review

The definition of art is rather broad. Visual arts include painting, sculpture, photography and other visual objects. Performing arts encompass music, theatre and film. Art shares some characteristics with other forms of collectibles such as Stradivarius violins and antique furniture, which have been the subject of previous studies. How is one to say that a perfectly crafted Stradivarius is not a piece of art? Where do we draw the border on what the definition of art is? It is problematic to attempt to capture all of the art available, not only given the wide variety of objects that could be classified as art, but also because of a lack of readily available data. Due to the fact that 90% of the turnover in the international art market pertains to paintings¹² and given the good sources of data on painting transactions, we have chosen to focus this study solely on paintings.

2.1.1 Early works and the return on investments in paintings

During the 1950's and 1960's, it was widely believed that the rate of return on investments in paintings was far greater than for comparably risky assets in the financial markets. Stein (1977) and Baumol (1986) debunked this general perception by performing two of the first studies on the markets for paintings. The latter triggered most of the literature within the field while they both contributed to changing the deep-rooted perception among experts and the public, namely that investments in paintings are lucrative.

¹¹ Auction houses set price estimates for paintings before the bidding starts. The 120% average means that auction houses on average sold paintings for 120% higher than the estimate.

¹² Fase (1996)

Baumol (1986) studied an extensive period of 300 years and found an annual real return of 0.55%, and he also found that returns are highly variable. Both of these findings are in agreement with the work conducted by Stein (1977). In addition, Baumol found that relatively short (less than 50 years) holding periods result in larger gains and losses than for relatively long holding periods where the returns approach zero. Additionally, Stein (1977) found further reasons as to why investments in paintings are not particularly good. For example, he concluded that the value of paintings is not secure during financial recessions but may fluctuate violently as for any other financial asset, which was contrary to the popular belief that paintings act as safe placements during volatile periods in the stock markets. Furthermore, Stein (1977) reasoned that investments in paintings contain a substantial element of non-systematic risk, which should deter any rational investor from holding a relatively large portion of wealth in this form. However, not all studies share this pessimistic view.

In contrast to Stein (1977) and Baumol (1986), Bryan (1985) found that the return on investments in paintings was high relative to other financial assets. For example, his findings show that the rate of return exceeded that of shares by approximately 30% and that of corporate bonds by 75%. A few years later, Fase (1996) reported a yearly nominal rate of return of 10.6%¹³ on nineteenth-century paintings, almost as high as for bonds during the period studied. More recently, Renneboog & Spaenjers (2013) found a yearly nominal rate of return of 8.21%¹⁴ over a 50-year long period, which further demonstrates the variation in returns on investments in paintings in previous literature. In addition to the discrepancies in financial returns, securities and paintings differ in many other ways as well.

2.1.2 Distinctions between shares and paintings

The return on an asset is only relevant when compared to the returns on alternative investments. Hence, the same comparison should be done for investments in paintings. The challenge is that these returns are not easily comparable to returns on say shares or bonds. Baumol (1986) discusses some of the major distinctions between securities and art.

Firstly, shares are homogenous goods available in large numbers and all being perfect substitutes. In other words, a share bought in a company will not differ from other shares in that same company¹⁵. Paintings on the other hand, give its owner a monopoly position, as each painting is unique. This is problematic since the pricing of the painting will be based on much less

¹³ Gross of transaction costs

¹⁴ Net of transaction costs

¹⁵ Disregarding any differences in share classes.

information as auctions are held infrequently whereas share prices are based on the aggregate valuation by thousands of investors willing and ready to transact in real time.

Secondly, share transactions occur continuously whereas some paintings may be traded once every century. This gives share prices the ability to update frequently and constantly react to new market information. Paintings on the other hand, can be “stuck” with an outdated valuation for a much longer time due to the infrequency of trade.

Lastly, the most striking difference between securities and paintings relates to the availability and viability of information for the purposes of constructing valuation models. Share values are equal to future cash flows discounted to a present value. The same holds for paintings, however the ability to reasonably predict the future cash flows generated by a painting is far more difficult. Nonetheless, even in a perfect world where an investor could accurately predict these cash flows, there would still be a portion of the value not accounted for.

2.1.3 Psychic returns, the unexplained portion of the value

As mentioned, many researchers have concluded that shares generate higher returns than investments in paintings and the reasons for why has concerned them for many years. The difference seems to pertain to so called psychic returns, which are usually omitted from the calculations of returns on investments in paintings. They are often claimed to be a non-quantifiable explanation of the discrepancy between share and painting returns. These returns can be viewed as cognitive returns, or as Baumol puts it “the return in the form of aesthetic pleasure” one receives from consuming art. Fase (1996) defines it eloquently: “The price paid annually for possessing works of art”.

Psychic returns have in themselves major implications for the valuation of other similar types of assets such as boats, vintage cars or other collectibles where the pleasure of ownership is high. The psychic return of consuming art is integral to understanding the overall profitability of investments in paintings. If one is to compare an investment in securities to an art investment, any potential differences between the two need to be taken into account. A share is purchased as a pure financial investment with no consumption (i.e. non-monetary) benefits until it is sold. On the other hand, a painting can be both held as a financial investment and be consumed at the same time. Would it not be reasonable to state that an investor receives non-monetary returns by viewing his or her painting? Should these returns then be ignored? The literature seems to be in agreement that the psychic returns are of importance when analyzing returns on the market for paintings. They are discussed in papers by Bryan (1985), Frey & Pommerehne (1989) and Fase

(1996). However, to our knowledge, only one complete attempt to quantify psychic returns has been made by Stein (1977) which was based on the US and British market.

Stein (1977) uses the rental market for paintings as a proxy for psychic returns. The reasoning is that when renting paintings, the lessee enjoys the consumption portion in isolation whilst the monetary gains accrue to the lessor or owner of the painting. This way, the rental fee isolates the pure viewing service received from works of art. Although rental fees vary depending on various factors discussed below, they give an indication of the magnitude of the psychic returns. The author found 11% of a painting's appraised value as the yearly psychic return. Stein (1977) ends his analysis by stating that art investments might actually be viable if psychic returns are taken into account.

Bryan (1985), while not performing any own calculations, still found that rental costs depend greatly on the type of art. In the case of traditional 19th and 20th century works, the average psychic return was about 30% compared to 13% for 19th century European paintings, which are assumedly more similar to the sample in our study. Contractual specifics such as who bears the cost of insurance or whether a buy option is included also govern the rental costs.¹⁶ Nevertheless, most authors merely mention this effect without any effort of quantifying it or assessing the impact this portion might have on overall net returns.

Our aim is to quantify the psychic returns by analyzing rental market prices for paintings in Sweden. Additionally, in order to be consistent in our comparison with the stock market, we have constructed a share index with reinvested dividends. By doing so, we capture both the price gains of investing in paintings and shares, in addition to the psychic returns of investing in paintings and dividends gained from investing in shares. The methodology of quantifying psychic returns is identical to the methodology Nasdaq uses to calculate its indices with reinvested dividends.¹⁷

2.1.4 Diversification benefits

Returns are not the only aspect to scrutinize when trying to assess the viability of an investment; a rational investor will also be interested in risk. Several studies have shown that paintings may act as an instrument of diversification in investment portfolios, which is important to take into account when making an investment decision. When it comes to the risk-reducing features of paintings, the literature is however not in complete agreement. Goetzmann (1993) finds a strong positive correlation between paintings and other assets, especially shares. This contrasts with the

¹⁶ Bryan (1985)

¹⁷ Nasdaq OMX (2016)

findings by Bryan (1985), Fase (1996), Mei and Moses (2002) and Agnello (2002) who find low correlations between paintings and market alternatives such as shares or bonds. Table 1 summarizes the correlations from previous studies.

Authors	Correlation between shares and paintings
Bryan (1985)	0.003 ^a
Goetzmann (1993)	0.67 ^b
Fase (1996)	n.a.
Agnello (2002)	0.230 ^a
Mei and Moses (2002)	0.040 ^a

^aShares are represented by the S&P500

^bShares are represented by the London Stock Exchange

Table 1

2.1.5 Methods used

A variety of methods have been used to calculate the return on investments in paintings in previous studies. The main methods are the Average Price Index (“API”), the Repeat Sales Regression (“RSR”) and the Hedonic Price Index (“HPI”). Before the turn of the millennium, RSR dominated the studies on the art market. On the other hand, after the early 2000’s, focus shifted towards the HPI method. The use of the API is sporadic with no accentuated shift in usage over time. Worth noting is also that the RSR and the HPI methods generally yield very similar results, at least in terms of overall trends, but the actual returns do differ.¹⁸ The construction, use and benefits of each method is elaborated on in more detail in Section 3.1 Research Design. We have created both an API and a HPI.

2.1.6 Studies on the Swedish art market

The international studies on the art markets paint a picture of big agreements and disagreements. Unfortunately, we are unaware of any published papers on the Swedish art market which we deem to be a clear omission in this field. Two pioneering studies in this subject field are two master theses by Hallius (1992) and Anderson & Björkman (2007) from the Stockholm School of Economics. It is our hope to expand this field of study and contribute to its future establishment, and we will do so by using the sample of artists defined by Hallius (1992) and update Anderson & Björkman’s dataset of 19,065¹⁹ transactions in paintings between 1985 and 2006 with 6,902 transactions covering the period from 2006 up until 2016.

The interest in art and paintings had increased at an enormous rate in Sweden during the 1980’s (further elaborated on in Section 4.3.1). It was in this setting that Hallius (1992) conducted his

¹⁸ Anderson & Björkman (2007); Ashenfelter & Graddy (2003)

¹⁹ The original dataset contained 19,213 auction sales. We have removed certain data points in order to strengthen the multivariate regression and subsequent calculation of the HPI.

research. He studied 2,700 oil paintings divided into 13 artist groups covering the price development during the period 1985-1991. The end of his studied period covered a turbulent part of the history of the Swedish economy due to the Swedish financial crisis that started in 1990. Hallius (1992) found, using an elaborated API method, that the nominal yearly return during the investigated period was about -10%. The driver of this negative return was concluded to be the high transaction costs involved when transacting in art. When these costs were set to similar levels as shares, about one percent, the returns were however still negative. Hallius (1992) furthermore noted that paintings seem to have a lower systematic risk than shares. However, several uncertainties remained unresolved in order for him to declare this conclusively. The uncertainties were due to the relatively short investigated period in combination with the general financial volatility of the time.

Anderson & Björkman (2007) build on the study by Hallius (1992) with a somewhat altered methodology. The key difference was the use of the HPI method, in addition to the API method. However, the choice of method did not materially influence the overall trend development over time, while it did affect the actual returns. In addition, the use of the HPI method enabled them to assess painting characteristics' effect on value.

Their results are in agreement with many of the previous studies: Art is not a lucrative investment. However, their findings suggest that an investor can decrease systematic risk by adding art to a portfolio. This is in line with the findings by Bryan (1985), Hallius (1992), Fase (1996) and Agnello (2002) that also speak for the diversification benefits.

Both studies also divided their datasets into sub-categories. Instead of dividing painters into groups of artists as Hallius (1992) did, Anderson & Björkman (2007) created three quality classes based on estimated price which showed dramatically different results. The high-price class showed higher price increases during the investigated period and also higher volatility when compared to the other price classes. The authors acknowledge that this may be due to the relatively low amount of objects in their category of highly priced paintings.

Table 2 summarizes the results from previous studies covering various markets from 1635 to 2011. Note that the Hedonic Price Index method has become increasingly popular in recent years. The results from the other Swedish studies are shown at the bottom of the table.

Authors	Year	Market	Period	# of observations	Nominal ^{ab}	Real ^{ac}	Method(s) ^d	Transaction costs
Anderson	1974	Europe	1780-1970	1,730	3.7%	3.0%	RSR	n.a.
Stein	1977	US & Britain	1946-1968	8,950	10.5%	n.a.	API	Not included
Bryan	1985	International	1971-1984	n.a.	19.0%	n.a.	Sotheby's	n.a.
Baumol	1986	International	1652-1961	640	n.a.	0.6%	RSR	Not included
Frey & Pommerehne	1989	International	1635-1949	1,198	n.a.	1.5%	RSR	Included
Goetzmann	1993	International	1715-1986	3,329	3.2%	2.0%	RSR	Not included
Pesando	1993	International	1977-1982	27,691	n.a.	1.5%	RSR	n.a.
Fase	1996	International	1972-1992	n.a.	10.6%	1.1%	API	Not included
Candela & Scorcu	1997	Italy	1983-1994	22,371	4.1%	-1.8%	API	n.a.
Bicy & Zanola	1999	International	1987-1995	1,446	n.a.	-3.0%	RSR	Not included
Agnello	2002	US	1971-1996	25,217	4.2%	n.a.	HPI	Not included
Mei & Moses	2002	US	1875-2000	4,896	n.a.	4.9%	RSR	Not included
Renneboog & Van Houtte	2002	Belgium	1970-1997	10,598	5.6%	n.a.	API and HPI	Included
Ashenfelter & Graddy	2003	US & Britain	1980-1991	>16,000	n.a.	4.0%	HPI and RSR	Not included
Hodgson & Vorkink	2004	Canada	1968-2001	12,821	7.6%	2.3%	HPI	Not included
Higgs & Worthington	2005	Australia	1973-2003	37,605	7.0%	n.a.	HPI and RSR	Not included
Renneboog & Spaenjers	2013	International	1957-2007	1,088,709	8.2%	4.0%	RSR and HPI	Included
Anderson et al.	2016	US	1987-2011	605	2.3%	-6.0%	RSR and HPI	Included
Hallius	1992	Sweden	1985-1991	2,737	-9% ^f	-16% ^f	API	Included
Anderson & Björkman ^g	2007	Sweden	1985-2006	19,213	0.2%	-3%	API and HPI	Included

Table 2

Notes: ^aIf several methods have been used, the return from the HPI method is presented
^bNominal yearly return
^cReal yearly return
^dThese methods are discussed in Section 3.1
^eIf the study includes transaction costs, the returns are presented net of them
^fAverages based on the author's results
^gWe had to reduce their data to 19,065 for the purposes of this study

2.2 What drives the value of paintings?

In order to create an HPI showing the price development of the Swedish market for paintings, some key value drivers have to be identified. We have limited our sample to a range of high-quality artists which in turn implicitly limits the genre. The other remaining attainable value drivers of a painting is the artist, the painting's size, whether it is signed (and if so, how²), and at what auction house it was sold. These value drivers will be used as independent variables in our regression analyses to help explain the price of a painting and to construct the HPI. The construction of the HPI will allow us to hold quality constant and measure pure price changes. The independent variables will now be discussed in turn.

2.2.1 Artists and quality

The artist is one of the main factors explaining the value of a painting because he or she gives an indication of quality and consequently of value. There is no clear definition of what a quality painting is but there are several quality indicators.

Painting technique is one of the main factors that govern painting quality. For example, Ginsburgh et al. (2005) find that oil paintings are generally more expensive. Higgs & Worthington (2005) state that the most desirable medium is oil because many high-quality works are made in this medium which is difficult to work with. Furthermore, oil is more permanent, and does not fade easily which makes these paintings more durable. As a result, we deem the quality of oil paintings to be relatively consistent, which is why we choose to only include such works.

Other indicators of quality are reputation of the artist, artistic merit, provenance and condition. When it comes to large samples, these variables are not easy to quantify. For example, the provenance of a painting may be difficult to obtain or be unknown. Even if this information had been available, it would require a thorough investigation of art history books which would be very time consuming. Given the relatively large database in the present study, these qualitative characteristics unfortunately had to be left out. It would be difficult, if not practically impossible, to obtain all of them in a manner that would be reasonable within the scope of a study of this kind. However, we rely on that the authenticity of the paintings in our database is confirmed by the signature of the artist.

In addition to the above indicators, Agnello (2002) found a negative value effect of living artists, which is later confirmed by Higgs & Worthington (2005) who found that deceased artists' works have higher prices in general. However, an earlier study by Agnello & Pierce (1996) found the opposite effect. Therefore, the value effect of living artists is not clear cut. Anderson & Björkman (2007) only include deceased artists in their study. Their reason is that the supply of paintings is held constant and that the artist does not have the possibility to affect prices of his or her paintings by e.g. marketing of their objects. In our reasoning, we concur with Anderson and Björkman (2007) and only include deceased artists.

2.2.2 Size

There is little doubt that the size of a painting affects its value. In several previous studies that have adopted a Hedonic Price Index methodology, size is a value increasing parameter.²⁰ However, size only has an increasing effect on value until a certain point. For example, large museum-size paintings seem to trade at a discount as compared to smaller paintings that are easier to handle. Renneboog & Spaenjers (2013) have positive regression coefficients on height and width but their surface area coefficient is negative which confirms this effect. In addition,

²⁰ Hodgson & Vorkink (2004); Higgs & Worthington (2005); Ginsburgh et al. (2005); Renneboog & Spaenjers (2013)

Renneboog & Van Houtte (2002) argue that there is an optimal size to paintings that is value maximizing. They refer to Docclo et al. (1994): The optimal painting size amounts to 58x40 cm² for old masters and 33x21 cm² for paintings of later periods. However, Hodgson & Vorkink (2004) find that only greater height increases value whereas width and surface area have negligible effects. This implies that there may be a scarcity premium to higher paintings since the landscape format is apparently rich in supply, at least on the Canadian market, where their study was conducted. The conclusion is that previous literature is not in complete agreement as to which size parameter increases value, but that there indeed is a positive relationship between size and the value of a painting. We have investigated whether the price premium is higher for higher or wider paintings in the Swedish market for paintings. A restriction is that the data containing transactions between 1985 to 2006 only contains information regarding surface area of the paintings. In our data from 2006 to 2016, we have added height and width in order to conduct a separate analysis.

2.2.3 Signature

In an international context, there are indications that signed paintings are worth more than unsigned ones as a signature certifies that an object is authentic. Renneboog & Spaenjers (2013) found that a signature and a date of creation on the painting increases its value by 31% and 19%, respectively. Auction transactions usually include information about signatures, which makes it possible to include them for the purposes of creating a Hedonic Price Index. However, a signature is not a guarantee of authenticity. For example, at one point there were 5,000 paintings by Jean-Baptiste-Camille Corot in the US while he allegedly had painted no more than 2,000 paintings²¹ in total. The complications do not stop there as even art experts have difficulties identifying fakes and forgeries,²² indicating the wide spread challenges within the industry.

We have seven types of signatures for the period 2006-2016 and three types for the period 1985-2006 as can be seen in Table 3 below. By adding paintings without signatures and paintings with additional types of signature, we are able to separately analyze the effect these variables have on the value of a painting in the Partial regression.

²¹ Fase (1996)

²² Frey & Pommerehne (1989)

<i>Complete Regression</i>		
Anderson & Björkman (1985-2006)	Kundu & Raza (2006-2016)	Explanation
Signature	Signature	Signature on the front of a painting
Signature verso	Signature verso	Signature on the back of a painting
Stamp	Stamp	Stamp on the front of a painting
<i>Partial Regression</i>		
	Kundu & Raza (2006-2016)	Explanation
	Initial	Initials on the front of a painting
	Stamp verso	Stamp on the back of a painting
	Initial verso	Initials on the back of a painting
	No signature	Painting without any signature

Table 3

2.2.4 Auction house

There are two main types of auctions. The first one is traditional hammer auctions, which this study is based upon. Hammer auctions have the general characteristic that they only include what they deem to be quality works and conduct physical auctions. Online auctions on the other hand, include objects of much more varied quality. For example, they include paintings that could not be sold at hammer auctions, because either the bids were too low or the paintings did not meet the quality standards to be sold there.

For the period 1985-2006, Anderson & Björkman (2007) found that Bukowskis and Stockholms Auktionsverk obtain the highest hammer prices, which is the price at which an item is sold at an auction. The situation on the Swedish market therefore seems comparable to that on the international market: There are two dominating auction houses where the most expensive paintings are sold.

Christie's and Sotheby's are the most renowned international auction houses. They consistently obtain the highest hammer prices, which has been found in several previous studies. For example, Renneboog & Van Houtte (2002) find that paintings are sold at a premium there, which is confirmed by Higgs & Worthington (2005) who argue that these auction houses systematically obtain higher prices due to reputation and market power. This has also been observed in a more recent study.²³ We are unaware of any previous studies that have investigated the ability of auction houses to sell paintings for prices close to their estimated prices. Now that we have discussed the value drivers, we will turn to the major factor hampering value creation in the market for paintings.

²³ Renneboog & Spaenjers (2013)

2.3 Comparison with the stock market and transaction costs

Transaction costs are necessary to take into account when comparing paintings with shares because they affect investment returns heavily. We will now discuss different types of transaction costs, then move on to how previous literature has handled them and finally present a discussion on how we will be treating them in the creation of our indices.

2.3.1 Description of different types of transaction costs

In order to sell a painting at an auction house, both the buyer and the seller usually have to pay a fee. Buyers of paintings typically pay about 15% of the hammer price while sellers pay about 10-12% on the Belgian market.²⁴ On the Swedish market, these fees differ somewhat in between auction houses but we have used Bukowskis purchase fee of 22.5% and sales provision fee of 16.3% (both including 25% VAT).²⁵

A second type of transaction costs are taxes. Stein (1977) states that there may be some tax advantages when transacting in paintings but that these are however offset by other costs, such as illiquidity costs. He therefore assumes the net premium to be close to zero, something that is common in studies of paintings. Furthermore, Fase (1996) and Frey & Pommerehne (1989) state that taxes vary a great deal in between jurisdictions which makes it difficult to generalize in this area. In our case, we exclude taxes as gains from investing in securities and paintings are taxed equally and we restrict our study to one jurisdiction.

Other transactions costs are insurance fees for the auction, in Sweden 1.25% of the estimated price of the painting, and a “droit de suite”. This fee is applicable 70 years after an artist has died and is calculated as 5% of the hammer price up to 50,000 EUR and then the percentage decreases gradually. The droit de suite can be as high as 12,500 EUR. Given the fact that droit de suite was enacted only in 1996 in the EU, in addition to uncertainties regarding living relatives of the artists, we have chosen to exclude this fee.

The total transaction costs for one sale may consequently amount to about 40% of the hammer price. This should be compared with brokerage fees of under 1% when transacting in shares. As we can see, the various transaction costs and differing rates in between countries introduce challenges when trying to compare international paintings from many different jurisdictions to shares.

²⁴ Renneboog & Van Houtte (2002)

²⁵ Price list, Bukowskis (2016)

2.3.2 Transaction costs in previous literature

Previous literature has handled transaction costs in different ways. Some have included them while others have disregarded them. Fase (1996) states that transaction costs are one of the main issues hampering research on paintings which makes it understandable that several authors choose to disregard them²⁶ when calculating the return investments in paintings.

Biey & Zanola's (1999) sample consists of internationally sold paintings recorded in four different currencies which could potentially be a reason for why they excluded transaction costs. On the other hand, Renneboog & Spaenjers (2013) do include transaction costs even though their data consists of over one million internationally sold paintings. Worth noting is that they do not take into account any differences in transaction costs. Frey & Pommerehne (1989) also included transaction costs even though they often have been unknown or unreliable for the period in their study.²⁷ Clearly, there does not seem to exist a common practice for how to handle transaction costs.

2.3.3 Consequences for the comparison between paintings and shares

As we have seen, previous studies have handled transaction costs in different ways. However, we see two main reasons for including them in our study.

Firstly, including transaction costs gives a more accurate depiction of reality. The following is an example: An investor that has the opportunity to invest in either shares or paintings on January 1st in a given year and is obligated to sell the asset at the end of that same year. They both yield an expected return of 10%. However, the transaction costs differ drastically in between the assets. The brokerage fee for the shares is 1% of the purchase amount and the total auction house commission fee is about 30%. A rational investor will always choose the shares since the "net amount" that ends up in his or her wallet is expected to be much larger even though the expected returns are the same before transaction costs. The paintings would have to increase in value by more than 30% in order for the investment to be worthwhile. As we can see from this example, the high transaction costs involved in the market for paintings should reasonably have implications for investor behavior.

The second reason for including transaction costs is that it increases the comparability between returns in the market for paintings and the stock market. As we have concluded, several previous studies have omitted transaction costs. We deem this to be a logical flaw because it makes a

²⁶ Fase (1996); Biey & Zanola (1999); Hodgson & Vorkink (2004)

²⁷ Frey & Eichenberger (1995)

comparison between the market for paintings and the stock market inconsistent. The high transaction costs involved in painting transactions are one of the main drivers why the market for paintings is illiquid as compared to stock markets.²⁸ For the reasons stated above, we have calculated returns both gross and net of transaction costs.

It is worth noting that we are interested in adjusting for the transaction costs involved when transacting in shares and paintings in order to arrive at a “net return”. However, it is not within the scope of this study to analyze how the mere existence of transaction costs is reflected in or impacts market prices. For a more detailed discussion on this matter, refer to Baker & Jorgensen (2012).

3. Method

3.1 Research design

The difficulty in calculating returns on the market for paintings is highly exemplified by the wide array of methods available including their limitations. We have chosen a hedonic price method in order to hold the factor of quality constant over time (to subsequently measure pure price changes) and used a return function, which adjusts for transaction costs and accounts for psychic returns. Subsequently, we have compared these returns with the return on a share index including reinvested dividends. The following section describes the most frequent methods used for creating painting indices and why we chose to use the Hedonic Price Index.

3.1.1 Average Price Index

The Average Price Index (“API”) is a naïve method and one of the most frequent methods used in the calculation of returns on painting. The price index is calculated by simply measuring the yearly changes of the average prices. In many aspects it is similar to the fixed-weight Laspeyres price index which is frequently used for the calculation of various indices. However, neither prices nor quantities are fixed over time, and the weighting of the numerator is based on the same time period t (hence divided by n_t below), rather than the base of fall 1985 (which would have been the case if this was a Laspeyres price index).

²⁸ Renneboog & Van Houtte (2002)

$$API_t = \frac{[\sum(P_{m,t} \times Q_{m,t})]/n_t}{[\sum(P_{m,Fall85} \times Q_{m,Fall85})]/n_{Fall85}} \times 100$$

Formula 1

We denote t as some point in time after the fall of 1985, m as a specific painting and n as the number of paintings sold at that point in time. The summation in the numerator is over all paintings sold at time t and in the denominator over all paintings sold in the fall of 1985. The API is simply the sum of the painting's price times its quantity (always 1 in our case), for all paintings sold during a specific period (6 month intervals in our case ranging from fall 1985 - spring 2016), divided by the number of paintings sold during that period. Consequently, one obtains an average price for that specific period, which is further divided by the average base (the fall of 1985) and multiplied by 100 to produce the index value.

The simplicity of the method is partly the reason why it has been used so frequently in the calculation of returns from investing in paintings.²⁹ The benefit of the API is that all data can be used meaning that paintings do not need to have both price information for when the painting was acquired and later for when it was sold.³⁰ However, the method relies on a set of strong assumptions. The construction of an API for paintings implicitly assumes that all the included paintings are equal in quality.³¹ E.g. if average prices were to increase between year t and $t+1$, one has to assume that all the paintings have the same quality and that the increase in value is a pure result of rising prices. That is, one disregards the likely scenario that paintings of higher/lower quality have been sold in various years which could be a significant contributor to the change in index value. Some researchers have tried to limit the impact of this assumption by only choosing a subset of paintings created by now deceased artists.³² However, by using an API, the assumption within a subset still remains as one has to equate the quality of the paintings and view them as close or perfect substitutes.³³ For example, even in our small subset of 88 artists, if we use price as a proxy for quality there are large differences. Paintings by Anders Zorn have sold for an average of 2,049,000 SEK while paintings by Anders Jönsson have sold for an average of 1,100 SEK. Thus, the large difference in price could arguably indicate a difference in quality within the sample.

²⁹ Stein (1977); Renneboog & Van Houtte (2002)

³⁰ Fase (1996)

³¹ Ibid.

³² Stein (1977)

³³ Candela & Scorcu (1997)

3.1.2 Sotheby's Index

Another method which has been used for a few of the studies reviewed³⁴ is Sotheby's Index. The index was created by The Times newspaper and Sotheby's with the aim of producing a monthly index.³⁵ The paintings within the index are classified into four categories based on school of art (e.g. impressionist, modern, old masters and nineteenth-century European paintings) with the composition being based on a fixed basket of objects. These objects are valued by Sotheby's art experts and updated in relation to specific price affecting events (e.g. auctions, major exhibitions or publications). The index was discontinued sometime during the 1970s.³⁶

The subjective appraisal by art experts implicitly means that the prices are determined partly based on the quality of the painting in question, as the value of each painting is determined individually. Hence, when constructing Sotheby's Index, no adjustment for quality needs to be made as the method links changes in price to individual paintings and hence isolates the price change.

However, the subjective estimations are per se not based on final hammer prices, i.e. the returns calculated based on the index do not represent returns to a potential investor, but rather the change in the value appraisals by the experts. For an art investor, the actual hammer prices are of interest as they reflect actual returns. In Section 4.2.2 we have analyzed the over-/under-valuation by auction houses by assessing their estimations in relation to actual hammer prices.

3.1.3 Repeat Sales Regression

As touched upon, the most common index methodology for the calculation of, e.g. consumer price indices, is the Laspeyres Price Index.³⁷ In practice, statisticians record prices of some products at one point in time e.g. t , then at some point in the future e.g. $t+1$ they record prices of the exact same products. The price index is then calculated by matching the price recorded in the later period with the prices recorded in the earlier period. Hence, this matched-model holds the quality of the products (as they are identical) constant, and allows for the measurement of pure price changes. However, because of long holding periods, the frequency of sales (i.e. prices recorded) is low and extends over long periods of time. Due to this reason, the traditional methods such as Laspeyres or Paasche price indices are not very useful for creating art and

³⁴ Fase (1996); Candela & Scorcu (1997)

³⁵ TIAS School for Business and Society (2016)

³⁶ Ibid.

³⁷ Triplett (2004)

painting indices. E.g. if we have one data point in 1950 and another one in 1980, we could not reasonably make assumptions on how the index development in between has been.

But there are ways of overcoming the challenge of long holding periods. One of the most frequently used methods for the construction of painting indices is the Repeat Sales Regression (“RSR”) which was initially developed to measure value changes in the real estate market.³⁸ RSR uses prices of individual objects from two distinct points in time, i.e. the purchase and sale of the painting in question. This reduces the issue of heterogeneity i.e. the need for adjusting data for differences in quality, as the price change is based on the exact same painting at two different points in time. These changes in price are then regressed against a set of dummy variables representing time. The method has been used extensively in previous research for the purposes of creating painting indices.³⁹ The point of departure for the construction of the RSR method is the multivariate log-linear model⁴⁰:

$$\ln P_{n,t} = \beta_0 + \sum_{k=1}^K \beta_k Z_{nk} + \varepsilon_n \quad \text{Formula 2}$$

Where $\ln P_{n,t}$ is the logarithm of the price of the painting n , at point in time t , and ε_n is a random error term. The β_k of the independent variables represents the price affecting characteristics (artist, size, signature, etc.). K represents the specific characteristic for painting n with Z representing the value of the characteristic. β_0 represents the intercept. Hence the change in value for painting n between two periods t and s is $P_{n,st}$:

$$\ln P_{n,t} - \ln P_{n,s} = \ln \left(\frac{P_{n,t}}{P_{n,s}} \right) = (\beta_{0,t} - \beta_{0,s} + (\varepsilon_{n,t} - \varepsilon_{n,s})) = \ln P_{n,st} + (\varepsilon_{n,t} - \varepsilon_{n,s}) \quad \text{Formula 3}$$

Which entails that the logarithm of the price change is the same for all paintings denoted P if we assume the error term to be insignificant or equal to zero. Now since the RSR can only be constructed based on transactions at different points in time, the dates will differ among the paintings. Since we assume that the prices of all individual paintings are expected to change at the same rate, the repeat sales can be pooled (i.e. each data point representing the change in price between the purchase and sale of a painting can be added together and be regressed against the time-dummy variables collectively) and estimated with the following formula:

³⁸ Fase (1996)

³⁹ Anderson (1974); Baumol (1986); Mei and Moses (2002)

⁴⁰ OECD et al. (2013)

$$\ln\left(\frac{P_{n,t}}{P_{n,s}}\right) = \sum_{d=1}^T \beta_t D_{n,d} + \varepsilon_n \quad \text{Formula 4}$$

Where $D_{n,d}$ represents a time dummy-variable which takes the value 1 when the sale occurs, -1 when the initial purchase occurred and 0 otherwise (this means of course that only one of the $D_{n,d}$ takes on the value of 1, namely that the $D_{n,d}$ for which $d = t$). Hence, as the method is in a log-linear functional form, the RSR index at point in time t , I_t , is obtained by calculating the exponential function of the dummy variable coefficient:

$$I_t = \exp(\beta_t) \quad \text{Formula 5}$$

3.1.4 Hedonic Price Index

Whilst the RSR method was frequently used in the early stages of the research on paintings valuation, the Hedonic Price Index (“HPI”) method became more popular in the mid-1990s.⁴¹ The basic idea underlying the HPI is that the value of individual paintings is a function of a set of value-affecting characteristics such as the artist, size, medium and date of creation of the painting. The multiple linear regression model for the estimated price of a painting, $P_{n,t}$, is the starting point for the HPI:

$$P_{n,t} = \beta_0 + \beta_1 X_1 + \dots + \beta_y X_y + \varepsilon_n \quad \text{Formula 6}$$

Where the β_0 is the intercept, $\beta_1 \dots \beta_y$ the model coefficients of the independent variables $X_1 \dots X_y$, and ε_n an error term. The HPI is basically a multivariate log-linear regression where independent dummy variables are assigned to represent points of sales in time. The coefficients of these time-dummy variables represent the value effect that time has on the prices of paintings isolated from the value effect of other hedonic characteristics (e.g. the effect of artist, size etc.). In our calculations, the double-log form is used since the preservation of the linear model is fundamental to calculating the HPI and the actual un-logged relationship between the dependent variable and the independent variable, size (S_n), is expected to be non-linear.⁴² This double-log form is the most common way of calculating the HPI:⁴³

⁴¹ Frey (1989); Ginsburgh et al. (2005); Chanel et al. (1996)

⁴² Aizcorbe (2014)

⁴³ Ginsburgh et al. (2005).

$$\ln P_{n,t} = \ln \beta_0 + \sum_{k=1}^K \ln \beta_k Z_{n,k} + \beta_s \ln S_n + \sum_{d=1}^T \ln \beta_d D_{n,d} + \varepsilon_n$$

Formula 7

The K parameters are value affecting characteristics, which in our case represents artists, signature and auction house. The only continuous variable in our dataset is size, represented by the S parameter, with the others (artist, signature, auction house) being dummy variables. The K terms control for differences in paintings attributes, the S_n term for size, and remaining influences on prices are delegated to the time dummy variables, $D_{n,d}$ (here again, only one of the $D_{n,d}$ takes on the value of 1, namely that the $D_{n,d}$ for which $d = t$).⁴⁴ As in the case of RSR, the price change over two periods is measured by the differences in the time dummy coefficients. The natural logarithm of the time dummy variable, β_t , yields an index value, I_t , at point in time, t .

$$I_t = \exp(\ln \beta_t) \times 100 \times \exp(0.5\text{Var}(\varepsilon_n))$$

Formula 8

This value is multiplied by 100 because our base value is 100 for the fall of 1985. The third factor to the right of the equality sign is a bias adjustment. As we use the logarithm of size and the dependent variable price and further use the anti-log of coefficient β_t of the time dummy, D , the mean and the standard deviations are biased and do not have a mean of zero and standard deviation of 1, hence the bias adjustment which normalizes for this effect.^{45 46} As these indices are chained by construction, the following formula is used to calculate the percentage change:

$$\Delta I\%_{t-1 \rightarrow t} = \left(\frac{I_t}{I_{t-1}} - 1 \right) \times 100$$

Formula 9

The index value at time t , I_t , is further divided by I_{t-1} in order to yield the period-to-period percentage change in value i.e. $\Delta I\%_{t-1 \rightarrow t}$. Note that I_{t-1} is equal to 100 in the fall of 1985.

3.1.5 The choice of HPI over RSR

As visible in Table 2 above, the general trend of the previous literature indicates that RSR was quite frequently used in the past whilst HPI became more common more recently. There are several advantages and disadvantages to each one of these two methods. The RSR needs far less characteristics than the HPI method. Only address (ID of painting), price and date of sale are needed to calculate the index. However, although one only needs a few characteristics, one of them, the address of a painting, is extremely difficult to obtain. Many of the artists use standard

⁴⁴ Anderson & Björkman (2007); Aizcorbe (2014)

⁴⁵ Aizcorbe (2014)

⁴⁶ The magnitude of this adjustment resulted in 26% increase in the HPI.

names such as “Fox in a winter landscape”, in standard sizes making identification of a repeat sale close to impossible. Partly due to the difficulties in identifying resales, but also due to the long holding periods thus infrequent sales,⁴⁷ the use of the RSR method can entail large reductions of data. As an example, Ginsburgh et al. (2005) were only able to identify 15% of the original data set as repeat sales. The use of the HPI allows for all recorded paintings to be used which is a major strength of this method. Studies have also shown that the results of applying both methods on the same dataset are not dramatically different in terms of trends⁴⁸ but the HPI produces smaller estimation errors.⁴⁹ Due to the mentioned benefits, and also because we are interested in assessing the value impact of a painting’s characteristics, we have chosen to use the HPI.

3.1.6 Choice of share index to compare

There are a few aspects to consider when comparing shares to the market for paintings. One of the fundamental questions is which share index to use as basis for comparison given that there are plenty to be compared with. Considering that the aim of creating the index is to evaluate Swedish paintings as an investment, our dataset only contains paintings created by Swedish artists and sold in Sweden. Hence, it would be reasonable to compare the painting index to a Swedish share index, as they could both reasonably be assumed to be subject to the same market conditions such as e.g. FX- and general regional economic fluctuations.

Additionally, in our attempt to capture quality we have chosen 88 of the most distinguished Swedish artists, limiting our need to adjust for quality by assuming that the subsample represents artists that are known for creating high-quality paintings. In order to be consistent, we have to apply the same reasoning of using a subset when choosing the share index.

However, since there is no share index data publicly available that covers the complete time period 1985-2016, we have chained two indices. Affärsvärldens General Index is a price index that covers the period fall 1985 to end of spring 2007. Subsequently, OMXS60PI is another price index that covers the period fall 2006 to spring 2016. Daily closing prices have been used and 6-month averages have been calculated for the fall and spring respectively for each year. For the overlapping periods, an average of both indices has been used. The reasonableness of chaining the two indices has been confirmed by calculating their correlation which was 0.99 for daily

⁴⁷ Baumol (1986)

⁴⁸ Renneboog & Van Houtte (2002); Anderson & Björkman (2007)

⁴⁹ Ginsburgh et al. (2005)

returns during the overlapping period. Both indices cover the majority of equity on the Stockholm stock exchange.

As mentioned, the unexplained portion of returns are concluded to be largely due to the psychic returns of investing in paintings, which is why we have estimated a so called psychic returns yield. In order to compare total returns of paintings with total share returns, we have to use a share index which includes the returns generated by dividends, namely OMXS60GI. However, it only extends back to 2006, as already mentioned. As the only difference between OMXS60PI and OMXS60GI is the reinvestment of dividends in the latter, we have calculated an average dividend yield of 4.2% per annum⁵⁰ (2.1% per 6 months). This dividend yield has been applied to the chained Affärsvärldens General Index and OMXS60PI. Based on the methodology of OMXS60GI, the following function has been used to calculate the sum of total dividends and the sum of psychic returns generated at point in time T , represented by R_T :

$$R_T = (I_{T-1} \times R\%) + \left(I_{T-2} \times R\% \times \frac{I_T}{I_{T-2}} \right) + \dots + \left(I_{T-t} \times R\% \times \frac{I_T}{I_{T-t}} \right)$$

Formula 10

Where the I_T , represents the index value (without reinvestment) at point in time T (i.e. either the share index- or painting index-value). The $R\%$ represents the dividend- or psychic return yield and t represents the number of periods between the base period and point in time T . Hence, the value of total dividends (or psychic returns) at point in time T is the sum of dividends of that period and the accumulated reinvested dividends from previous periods. The function is further simplified to:

$$R_T = (I_T \times R\%) \times (T - t)$$

Formula 11

3.1.7 Calculation of returns

In order to account for the returns generated to investors we will calculate the Average Price Return (“APR”) adjusted for transaction costs. The APR most resembles the actual changes of an investment over time from the perspective of an investor. Taxes have not been accounted for as gains from both paintings and investments in shares are considered to be capital gains, thus taxed at the same rate.⁵¹

⁵⁰ The annual dividend yield on the Stockholm stock exchange has been c. 4% between 1901-2012 (Sveriges Riksbank, 2014). Additionally, Dimson et al. (2000) calculated the geometric average annual dividend yield to 5% for the UK market. The ending values in 2000 of indices without and with reinvested dividends were 16,946 and 161 respectively. Both indices started with the value of 1 in 1900.

⁵¹ The Swedish Tax Authority (2016)

Naturally the transaction costs for both paintings and shares vary depending on broker/auction house, volume and point in time. As an example, while Avanza, a Swedish bank, charges 0.069% in brokerage fees per transaction,⁵² Nordea, another Swedish bank, charges 0.25%.⁵³ For hammer auctions, Bukowskis charges 22.5% of the hammer price for purchases of paintings and 16.3% for sales.⁵⁴ Concurrently, the auction house Crafoord charges 18% for purchases and 12% for sales. When it comes to volume, e.g., Avanza has different price classes for customers depending on the volumes they transact, and one could also reasonably speculate that the brokerage fees have decreased significantly over time as traditional physical clearing has been digitalized. Nonetheless, we have used brokerage fees of 0.069% for shares and provision fees of 16.3% for sales and 22.5% for purchases as proxies. The brokerage fees are for mid-volume customers at Avanza and the provision fees are from Bukowskis, that represents the highest number of transactions in paintings.⁵⁵ The following is the function used for the calculation of returns over time:

$$APR = \left[\frac{(I_T + R_T)(1 - PROV_S)}{(I_{T-t} + R_{T-t})(1 + PROV_B)} \right]^{1/(T-t)} - 1 \quad \text{Formula 12}$$

Where the sum of the price index I_T and dividends R_T at point in time T is multiplied with the provision $(1 - \text{the provision rate})$ for sales to reduce for provision costs. This is then divided by the sum of the base price value I_{T-t} and the base dividends value R_{T-t} which is increased by the additional purchase provision paid. The geometric yearly average return is then obtained by raising the described function to $1/(T - t)$. Note that R is equal to zero in the calculations where we exclude psychic returns and dividends.

3.2 Data analysis

We have performed two separate regression analyses in this study. The first one covers the period 1985 to 2016 and is based on Anderson & Björkman's (2007) dataset between the period 1985 and the spring of 2006 in combination with our added data covering the fall of 2006 until 2016. In order to link the two datasets to construct a complete Hedonic Price Index, we had to disregard the additional variables (listed under Partial regression in Table 4). We refer to the first regression analysis as "Complete regression" throughout the paper.

⁵² Pricelist, Swedish bank Avanza (2016)

⁵³ Pricelist, Swedish bank Nordea (2016)

⁵⁴ Price list, Bukowskis (2016)

⁵⁵ Anderson & Björkman (2007)

In our data, we include more variables such as height/width (Anderson & Björkman only had access to surface area), date of creation and additional types of signatures. We have performed a separate analysis on this data in order to measure the price effect of the additional variables. We refer to the separate regression analysis as “Partial regression” throughout the paper.

<i>Complete Regression</i>		
Anderson & Björkman (1985-2006)	Kundu & Raza (2006-2016)	Explanation
Hammer price	Hammer price	Sales price of the painting
Artist	Artist	The artist who painted the painting
Auction house	Auction house	The auction house that sold the painting
Sale date	Sale date	The date of sale
Surface area	Surface area	The surface area of the painting in cm ²
Signature	Signature	Signature on the front of a painting
Signature verso	Signature verso	Signature on the back of a painting
Stamp	Stamp	Stamp on the front of a painting
<i>Partial regression</i>		
Anderson & Björkman (1985-2006)	Kundu & Raza (2006-2016)	Explanation
	Initial	Initials on the front of a painting
	Stamp verso	Stamp on the back of a painting
	Initial verso	Initials on the back of a painting
	No signature	Painting without any signature
	Date of creation	The year when the painting was created
	Height	Height of the painting in cm
	Width	Width of the painting in cm

Table 4

3.3 Data collection

3.3.1 Data source

The data source we have used for 2006-2016 is the online database Artprice, a widely accepted source of art data.⁵⁶ It is constructed based on sales from 4,500 auction houses globally and allows us to view auction data from 2006-2016 (however, Artprice goes back further than that). We collected 6,902 painting transactions which we added to the dataset in Anderson & Björkman (2007). In total we have 25,967 sales of oil paintings sold in Sweden made by 88 Swedish artists in our sample.

We have identified a few potential risks with using Artprice. It is possible that not all auction transactions from Swedish auctions are included. Another potential risk is that some of the auction information in Artprice is incorrect because of human errors when the data was entered. However, we have compared a handful of transactions with auction houses’ websites in order to

⁵⁶ Hallius (2016). He has over 20 years of experience as an expert in Swedish art auctions and is the one who wrote the first master thesis at the Stockholm School of Economics on the topic of investments in paintings (as already mentioned above).

validate the information from Artprice. Based on this admittedly superficial comparison, we felt that we could use the Artprice database.

3.3.2 Demarcations

In order to analyze paintings as an investment, we have collected the auction data shown in Table 4. The data will allow us to compute a price index that will be compared to a share price index. We have introduced several delimitations in our research in order to make the sample more homogenous. While art could essentially be anything from violins to sculptures, we aim our focus on paintings. They represent a majority of the Swedish art market, and there is publicly available and reliable information on transactions in paintings. In addition, most of the previous art literature seems to focus on paintings, probably due to similar reasons.

We will analyze a predetermined set of Swedish classical and modern artists for the period 1985-2016. Our starting point is the previous master thesis by Anderson & Björkman (2007; already mentioned above), and we will use the same 88 artists as they did. Our selection was originally made with the help of Ulf Hallius. The selection criteria were based on the general quality of the paintings produced by the artist and their respective yearly turnovers on the Swedish market for paintings. All of these artists were considered to have made contributions of high importance to Swedish fine arts and are considered quality artists. We only include artists who are deceased, which guarantees that the supply of their paintings cannot be increased and that they cannot affect their reputation by for example marketing.

Only oil paintings are included in our database since they usually are of the highest quality as discussed in Section 2.2.1. Oil is difficult to work with and generally results in durable paintings. Worth noting is that oil paintings account for 80-90% of the Swedish quality art market⁵⁷ which makes them likely to be considered by anyone contemplating an investment in paintings.

A buy-in means that a seller intended to sell the painting but the bidding did not meet the reservation price, which is the lowest price accepted in order to sell. Many paintings are bought-in which is problematic when creating indices because there are no transaction prices for paintings that were bought-in (as they were not sold). Hence, obviously they cannot be included in the indices as we will discuss in the next section.

We only use data from hammer auctions, which means that no sales from online auctions are included. By limiting our sources, we increase the probability of having quality paintings in our

⁵⁷ Anderson & Björkman (2007)

sample. However, paintings are not only sold via traditional hammer auctions or online auctions. In some cases, they are sold by art-dealers. As no comprehensive database exists containing this data (as these are private transactions, public information might not exist at all), we cannot gather data on these transactions. Hence, there is a possibility that non-auction transactions would yield different results than we have calculated, given that our data is solely based on auction transactions.

No effort has been made to adjust for maintenance and restoration costs given the uncertainty involved. The extent to which a painting incurs maintenance costs varies depending on e.g. its age, the quality of colors used and the needs of the owner. Given the high diversity of paintings in our sample, we think that the inclusion of these costs would generate more uncertainty regarding the return on paintings. However, we acknowledge that such costs do reduce the returns painting owners obtain and need to be taken into account. Our index should therefore be seen as an upper bound on the returns an investor would be able to receive from transacting in paintings.

Finally, for the purposes of extending the HPI to cover the complete period between 1985 to 2016, we had to exclude paintings without any form of signature for the Complete regression to build upon the data collected by Anderson & Björkman (2007). Their reasoning for excluding paintings without signatures was related to questionability regarding the painting's authenticity. For the data we collected covering the period 2006-2016, we kept a separate database where we included unsigned paintings in order to measure any systematic differences in price attributable to the signature or non-signature of a painting. This separate database was used in our Partial regression.

3.3.3 Selection biases

The data source in this study is based on auction sales, as mentioned. However, there are a few issues with using auction data. Goetzmann (1993) argues that auctions may fail to capture price fluctuations of low demand or out-of-fashion paintings. Since these paintings are never sold at an auction, their price variations become invisible in the data, which may affect the price index either upwards or downwards. For example, some very expensive paintings are low in demand solely because of their price, which would depress the price index since fewer high priced objects are included. On the other hand, some paintings are low in demand and cheap because they are no longer in fashion or are of low quality. Their exclusion would rather inflate the index.

Furthermore, Goetzmann (1993) argues that the inability to capture price effects of bought-in paintings inflate painting indices, which is confirmed by a recent study by Anderson et al. (2016). The reasoning is that only paintings that received a bid high enough are included in the auction data while the paintings with low bids are bought-in and as a result not sold. Comparatively, share prices are continuously available as it is the unwillingness of investors to buy shares at current price levels that results in a negative share price development. The same mechanism is not present at hammer auctions as bought-in works are excluded, and hence the result is a neutral price development for the particular painting. Also, due to the high transaction costs, a sale of a painting might be conditional upon a substantial value increase which may depress the index since a profitable resale can only be achieved when the painting is valuable enough to net out transaction costs.

Another issue is that auction data does not include all of the sales⁵⁸ since some of the paintings are sold directly by art-dealers as discussed in the previous section. It is not clear how large the Swedish auction market is compared to the total Swedish art market, and the figures on the international market vary. Ginsburgh et al. (2005) state that the auction market represents 10-20% of the art market while a recent report by TEFAF⁵⁹ found that the figure is about 50%.

Frey & Pommerehne (1989) add to the discussion by arguing that auction houses are interested in high turnover, which may make them prone to accepting works that sell easily. This may bias the index upwards since paintings that are relatively difficult to sell are not represented. However, more recently, auction houses have become more willing to accept a wider array of paintings since paintings that are not sold at hammer auctions can instead be sold online,⁶⁰ which could potentially depress an index due to the lower price objects that are included. As a comparison, on the stock market, an investor may sell a share whenever he pleases, regardless of what the share exchange thinks of his shares. The stock market is in that sense less influenced by the stock exchange than the auction market is by the auction houses.

The low liquidity in the market for paintings has been discussed frequently in the previous literature. For example, Renneboog & Van Houtte (2002) concluded that the reason why paintings do not frequently return to the auctions is high transaction costs. This is illustrated by the estimated average holding period in Sweden of about 100 years.⁶¹ The illiquidity makes the market for paintings less efficient in the sense that prices take a long time to update, which

⁵⁸ Ginsburgh et al. (2005)

⁵⁹ The European Fine Art Fair (2016)

⁶⁰ Hallius (2016)

⁶¹ Anderson & Björkman (2007)

results in the index being biased either upwards or downwards depending on the value of the painting. Table 5 summarizes the sources of bias and their respective effects on the index.

Source of bias	Effect on index
Low demand pieces excluded	+/-
Inability to capture bought-in paintings	+
Transaction costs	-
Not all paintings sold at auctions	+/-
Auction houses interested in high turnover	+/-
Long holding periods	+/-

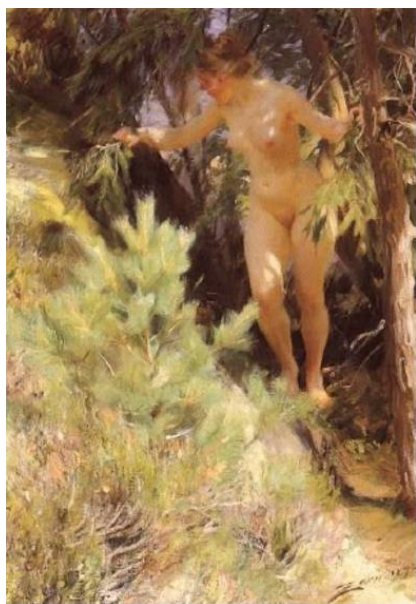
Table 5

4. Empirics

The following section is divided into three parts with each part covering main analyses and resulting conclusions. The first part covers the API, which we have used as a basis for describing our underlying data, followed by the second section where we describe the hedonic characteristics' impact on the price. In the third part we initially present and discuss the development of the HPI in relation to a Swedish share index which we lastly conclude by including psychic returns.

The data used as a basis for our research contains a total of 25,967 sold paintings painted by 88 artists⁶² over the period 1985-2016. The Complete regression achieved an impressive R^2 of 72.1% which implies that 72.1% of the variation of a paintings price can be explained by our independent variables.⁶³

The average price per painting over the complete time period was 93,000 SEK. The three most expensive paintings sold, all painted by Anders Zorn, were "Naken under en Gran" (Bukowskis, 1989, 13.2 MSEK), "Hämta Vatten" (Beijers Auktioner, 1989, 13.2 MSEK) and "Reflexer" (Stockholms Auktionsverk, 2014, 10 MSEK). Paintings by Anders Zorn represented 45 out of the 50 most expensive paintings sold in our sample.



"Naken under en Gran"



"Reflexer"

A list of data included, by artist and auction house, in addition to the regression outputs, can be found in the appendix.

⁶² August Strindberg (1849-1912) is not included in our sample of artists due to small number of produced paintings.

⁶³ Anderson & Björkman (2007) achieved an R^2 of 71.9%, Higgs & Worthington (2005) achieved 68% and Agnello (2002) achieved 64%.

4.1 Average Price Index

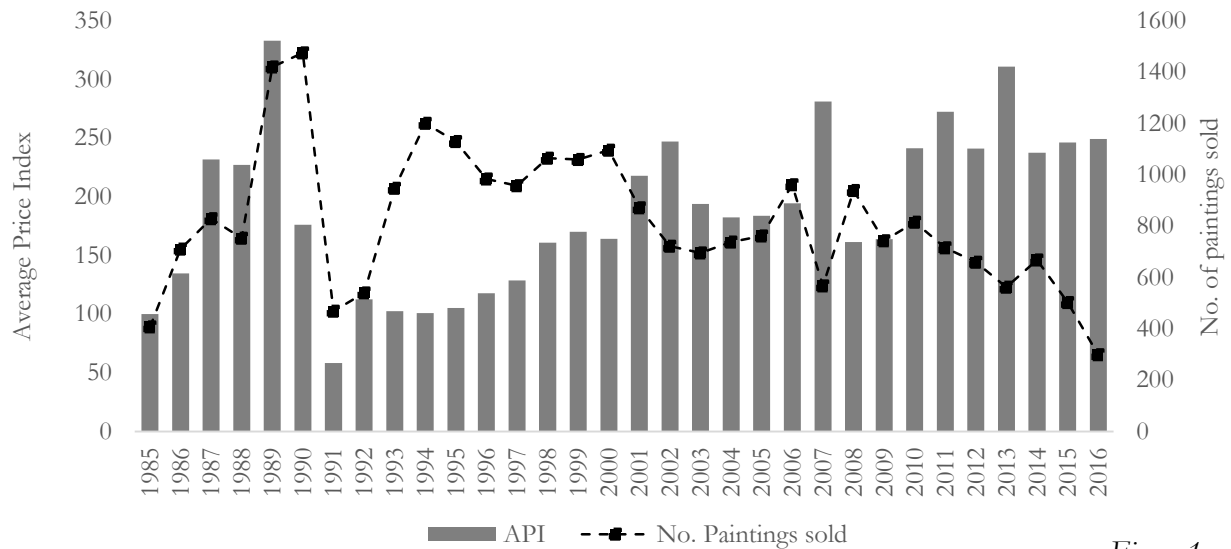


Figure 1

Figure 1 above seems to indicate two initial trends. The first trend seems to be that prices have increased steadily since 1991 and the other that the number of paintings sold has decreased since the year 2000.

4.1.1 Price

Following the discussion in Section 3.1.1, we cannot reasonably make the strong assumption that the quality of all the paintings is equal (hence the reason for using HPI which mitigates the effects of quality on price). Therefore, any changes in the API could potentially be due to actual changes in price, but they could also be due to certain paintings of high value being sold in a specific year. E.g. in 1989, the two paintings mentioned “Hämta Vatten” and “Naken under en gran” by Anders Zorn were sold for 13.2 MSEK each. Compared to the average price over the whole time period, the sale of these two paintings surely has an impact on the average price in 1989. Does then the reduction in average price in 1990 result from a general price decrease in the market of high quality paintings? Or is it simply the result of paintings with lower value being sold in that year? These questions highlight the use and benefit of the HPI which we will further elaborate in Section 4.2 below.

4.1.2 Number of paintings sold

In Figure 1 above, one of the most striking trends seems to be the decrease in the number of paintings sold per year. The decrease seems to have started as a trend around the year 2000, i.e. around the time of the IT-bubble. In fact, the average number of paintings sold between 1985

and 2000 was 940 paintings per year. Between 2001 and 2016 the average decreased to 701 paintings per year. Given the large amount of data in our sample, we can assume that the decrease is representative for Swedish high-quality paintings. However, the question of whether sales have actually decreased or migrated to other sales channels remains. Experts confirm that the decrease in the number of sales per year is actually a migration towards online auctions.⁶⁴

As elaborated on further below in Section 4.2.2, most of the auction houses have moved part or all of their traditional hammer auctions to online auctions instead. However, online auctions tend to sell objects of lower quality than traditional hammer auctions. Thus, we would not expect to find paintings in our database being offered online, yet we still do.

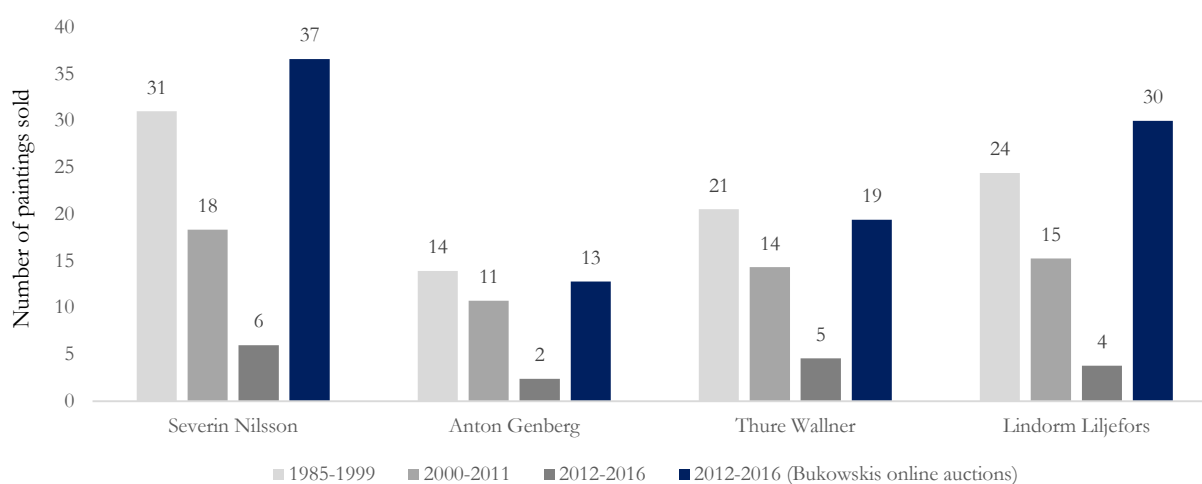


Figure 2

Figure 2 shows the number of paintings sold for a sample of four artists which are part of our larger dataset. As mentioned, this shows how a number of paintings sold through traditional hammer auctions are nowadays sold through online auctions instead. Interviewed experts confirm that online auctions are seen as a second alternative to selling high-quality paintings through traditional hammer auctions.⁶⁵ I.e. if a painting does not sell through a traditional hammer auction, the auction houses will try to sell it through their online platforms. In fact, the portion of buy-ins has increased dramatically over the past decades. In the 1980s, less than 10% of all paintings offered on hammer auctions were bought-in. This has increased to 30-35% in recent years.⁶⁶

⁶⁴ Customer representative Helsingborgs Auktionverk (2016)

⁶⁵ Hallius (2016)

⁶⁶ Ibid.

4.2 Hedonic Price Characteristics

4.2.1 Artists

<i>Top 10 by Average Price</i>		<i>Top 10 by Paintings Sold</i>	
Artist	KSEK	Artist	# Paintings
ZORN, ANDERS	2,103	LILJEFORS, BRUNO	1,014
LARSSON, CARL	606	STOOPENDAAL, MOSSE	781
HJERTÉN, SIGRID	404	PERSON, RAGNAR	774
ADRIAN-NILSSON, GÖSTA	310	GRUNEWALD, ISAAC	757
KYLBERG, CARL	262	NILSON, SEVERIN	714
LILJEFORS, BRUNO	247	OSSLUND, HELMER	696
BAERTLING, OLLE	245	EKSTRÖM, PER	662
OLSSON-HAGALUND, OLLE	244	KROUTHÉN, JOHAN	646
JANSSON, EUGENE	189	ERIXSON, SVEN	641
IVARSSON, IVAN	166	JOLIN, EINAR	637
Total Avg.	96	Total Avg.	295

Table 6

Number of paintings sold

In our database, Bruno Liljefors (1860-1939), with a total of 1,014 paintings, is the artist with the highest number of paintings sold during the investigated period. He is followed by Mosse Stoopendaal (1901-1948) and Ragnar Persson (1905-1993) with 781 and 774 paintings respectively. This should be seen in light of the fact that the average number of paintings by artists in our database is 295.⁶⁷ The results are not surprising since Liljefors has been said to be one of Sweden's most productive artists. Artists usually produce around 1,000 to 2,000 paintings during the course of their lifetime.⁶⁸ Liljefors however, produced around 5,000 paintings. Furthermore, Stoopendaal is said to be highly inspired by Liljefors and often painted similar wildlife style paintings. The fact that these two artists have the highest numbers of sales during the studied period could be a reflection of the demand and popularity of wildlife motives on the Swedish market.

Prices

Anders Zorn is the artist with the highest average price per painting (2,103,000 SEK), followed by Carl Larsson (1853-1919) and Sigrid Hjertén (1885-1948) with an average price of 606,000 SEK and 404,000 SEK respectively. It is notable that the paintings by these artists have not generated particularly high turnovers. Zorn's, Larsson's and Hjertén's paintings were sold 195, 54 and 280 times respectively, which is lower than the average of 295 paintings per artist, indicating that high value paintings are sold rather infrequently.

⁶⁷ Total number of paintings sold divided by number of artists (25,967 / 88 = 295)

⁶⁸ Anderson & Björkman (2007)

Price premiums

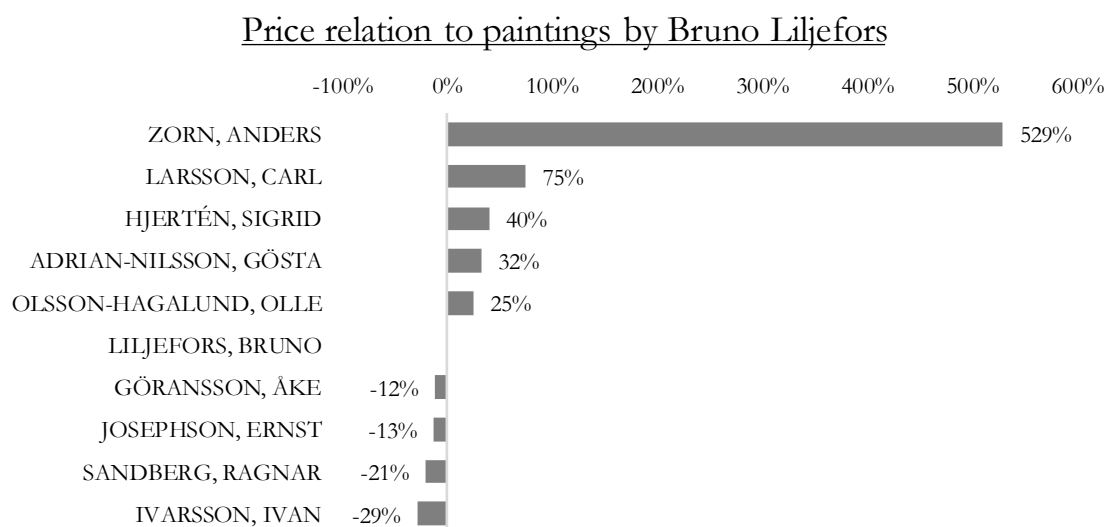


Figure 3

The process of constructing the HPI enables us to reduce or isolate the effects that individual characteristics have on the overall price. In relation to Bruno Liljefors, the sole fact that a painting was created by Anders Zorn resulted in a price premium of 529%,⁶⁹ all else equal. In contrast, paintings created by Ivan Ivarsson (1900-1939) yielded a discount of 29% in relation to paintings by Bruno Liljefors.

The inclusion of artist as an independent variable captures both the quality effect on price, but since different artists usually specialize in painting specific genres, the variable might also capture buyer's preferences of genre. Anders Zorn is known for portrait- and nude paintings whilst Carl Larsson is mostly known for painting garden motives, often including his family. Both artists are however considered to belong to the classical school of art.⁷⁰ In contrast, Sigrid Hjertén and Gösta Adrian-Nilsson are renowned for their modernist paintings. The spread of classic as compared to modern art is fairly evenly distributed in terms of price premiums.

⁶⁹ In order to calculate the price premiums, we use the formula $\exp(\ln \beta_k)$ to obtain the effect of the artist's dummy variable which we then compare to our base artist (Bruno Liljefors). In the case of Anders Zorn, we use the $\beta_k = 1.84$ from our regression table in Section 7.3. By applying the formula above, we obtain the value $\exp(1.84) = 6.29$ which compared to the base value for Bruno Liljefors which equals $\exp(0) = 1$. The result is then $529\% = (6.29 / 1 - 1) / 100$

⁷⁰ Hallius (2016)

4.2.2 Auction House

<i>Top 10 by Average Price</i>		<i>Top 10 by Paintings Sold</i>	
Auction House	KSEK	Auction House	# Paintings
BUKOWSKIS	148	BUKOWSKIS	8,059
BEIJERS AUKTIONER	121	STOCKHOLMS AUKTIONSVERK	6,414
NORDÉN AUKTIONER	105	UPPSALA AUKTIONSKAMMARE	1,852
HALMSTADS AUKTIONSKAMMARE	91	BEIJERS AUKTIONER	1,749
STOCKHOLMS AUKTIONSVERK	90	GÖTEBORGS AUKTIONSVERK	1,469
ÖSTGÖTA ANTIK	77	NORDÉN AUKTIONER	1,413
UPPSALA AUKTIONSKAMMARE	59	LILLA BUKOWSKIS	1,205
BRUUN RASMUSSEN KONSTAUKTIONER	49	FALKKLOOS AUKTIONER	766
SÖDERKÖPINGS AUKTIONSKAMMARE	48	CRAFOORD	474
GÖTEBORGS AUKTIONSVERK	30	AUKTIONSHUSET VON SCHÉELE	458
Total Avg.	45	Total Avg.	1,119

Table 7

Number of paintings sold

Out of the 25,967 paintings sold in our sample, 14,473, or 56%, are represented by Bukowskis and Stockholms Auktionsverk. They are followed by Uppsala Auktionskammare and Beijers Auktioner with 1,852 and 1,749 paintings sold respectively. Worth noting is that Beijers Auktioner was acquired by Bukowskis in 1992, thus any potential sales after the acquisition is recorded via Bukowskis. In fact, during the course of the studied period, consolidation of the auction house market has occurred. E.g. Bukowskis acquired Auktionskompaniet i Malmö, Auktionskompaniet i Stockholm, Malmö kvalitetsauktioner and Norrköpings Auktionsverk, which are all part of our sample.

Development of the internet

In recent years, the fast-paced development of the internet has created new opportunities for auction houses to reach out to a wider customer base. Previously, bidders had to physically be present or in some rare cases could place their bids via telephone. Now, some auction houses such as Auktionshuset von Schéele and Bukowskis Market⁷¹ have completely migrated to online auctions. This migration is said to have led very quickly to increased prices. Bukowskis stated that their migration to online auctions even mitigated the effects of the financial crisis which impacted other auction houses negatively.⁷² Helsingborgs Auktionsverk, which was purchased by the online auction site Lauritz.com confirmed the effects, and added that many sellers are still reluctant to sell their paintings online.⁷³ The reasoning is stated to be due to online auctions being considered as socialist in the sense that the paintings are available to a wider market.⁷⁴ The shift towards

⁷¹ Data for Auktionshuset von Schéele only includes data up until the point of their transfer to online auctions.

⁷² Customer representative Bukowskis (2016)

⁷³ Customer representative Helsingborgs Auktionverk (2016)

⁷⁴ Customer representative Helsingborgs Auktionverk (2016)

online auctions is expected to continue partly since it enables reaching out to a wider customer base, which translates into higher prices, but also due to the resulting higher margins of online sales.⁷⁵

Price relation to paintings sold by Bukowskis

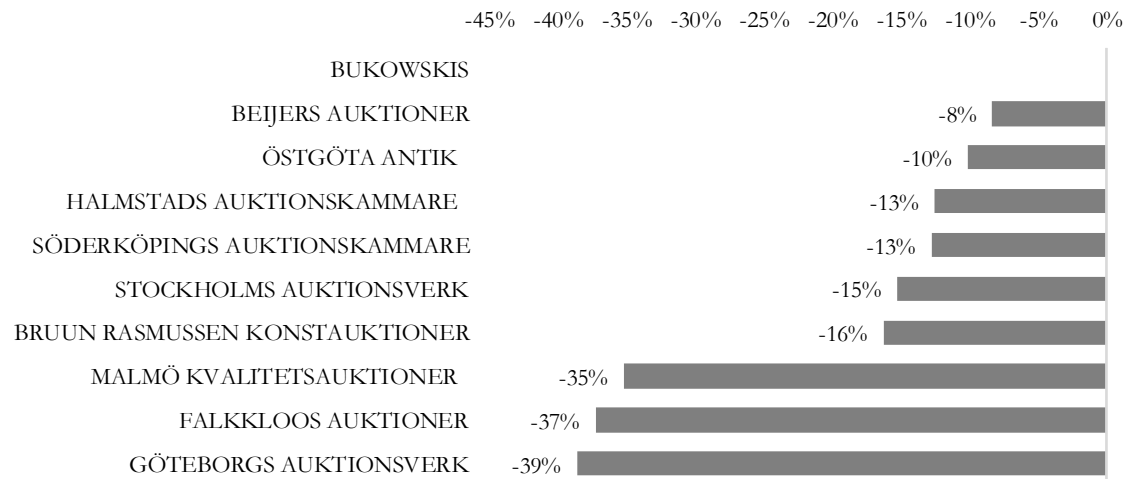


Figure 4

The highest average price

Not only did Bukowskis sell the highest number of paintings during the studied period, paintings sold via Bukowskis had an average price of 148,000 SEK which is substantially higher than the average of all individual auction house averages of 45,000 SEK. Out of the six paintings sold for above 10 MSEK (all painted by Anders Zorn), Bukowskis sold four, one was sold by Beijers Auktioner and one by Stockholms Auktionsverk. As shown in Figure 4, all else equal, a painting sold at Stockholms Auktionsverk was sold at a discount of 15% in relation to a painting sold via Bukowskis. Uppsala Auktionskammare, the auction house with the third highest number of paintings sold, sold for a discount of 46% in relation to Bukowskis.

⁷⁵ Hallius (2016)

Historical accuracy of estimates

Top 10 by Price / Estimate

Auction House	Price / Est.
VÄTTERBYGGDENS AUKTIONSKA	135%
CRAFOORD	132%
BEIJERS AUKTIONER	131%
MALMÖ KVALITETSAUKTIONER	130%
AUKTIONSHUSET VON SCHÉELE	127%
BUKOWSKIS	125%
SKÅNES AUKTIONSVERK	118%
LILLA BUKOWSKIS	117%
STOCKHOLMS AUKTIONSVERK	117%
UPPSALA AUKTIONSKAMMARE	116%
Total Avg.	120%

Table 8

As common practice, auction houses estimate prices of objects put up for sale before bidding starts. Our database contains both hammer prices and these estimates. Table 8 above indicates that on average, Bukowskis sells paintings 125% higher than the set estimate. Considering that the average price to estimate ratio in our database is higher than 1, there seems to be a systematic underestimation of the paintings put out for auction by the Swedish auction houses. Over time, the two largest auction houses along with the rest of the market have sold paintings for hammer prices much closer to their original estimates as seen in Table 9.

Historical Averages of Price / Estimate

Auction House	85-96	96-06	06-16
BUKOWSKIS	136%	124%	109%
STOCKHOLMS AUKTIONSVERK	120%	120%	112%
Total Avg.	124%	119%	113%

Table 9

4.2.3 Signature

<i>Number of Paintings by Signature</i>		
Type	# of paintings	% of total
Signed	24,944	96%
Verso	408	2%
Stamp	615	2%
Total	25,967	100%

Table 10

The database created by Anderson & Björkman (2007) disregarded paintings without signature. The reasoning was that a painting with a signature or stamp indicating the name of the artist is a better way of authenticating the painting. Authentication in the absence of a signature or a stamp was regarded as practically impossible for each painting given the large number of paintings in the dataset.⁷⁶ As such, our Complete regression only includes transactions of paintings which have signatures. The price effect is that a painting with a verso signature (on the back) was sold at a discount of 8%, all else equal, in relation to a signature on the front. A painting with a stamp signature was sold at a discount of 10% in relation to a signature on the front.

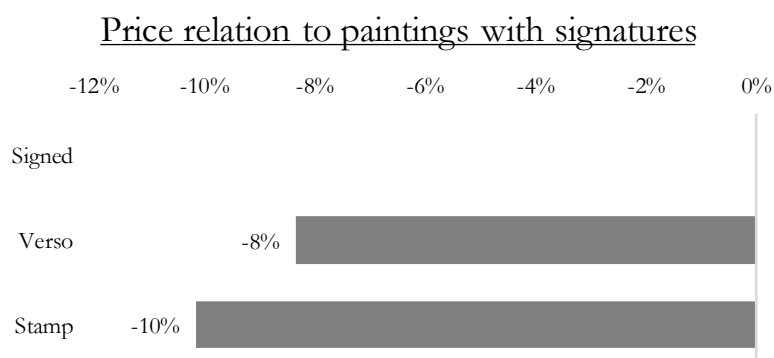
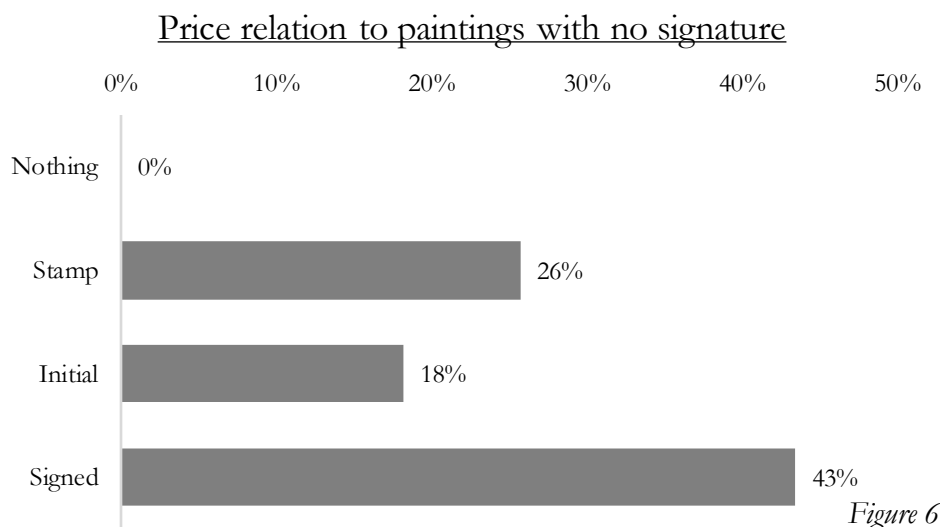


Figure 5

Partial regression

We chose to include additional variables in the 6,902 transactions in paintings that we added to the dataset created by Anderson & Björkman (2007). By using the data covering 2006-2016 we were able to run the Partial regression and assess the price impact of additional variables.

⁷⁶ Anderson & Björkman (2007)



The added variables are paintings without any type of signature and signatures with initials. As indicated by the Partial regression, a signed painting sells for about 43% more than a painting without any form of signature, all else equal. The finicky reader can now see that the relationship between a signed painting and a painting with a stamp in Figure 6 is not equal to the 10% discount described above in Figure 5. The reason for this discrepancy could be due to added variables in the Partial regression (Figure 6) and a reduction in the number of observations (25,967 reduced to 6,902). However, as the reduced dataset covers the period fall 2006 – spring 2016, whilst the complete dataset covers the period fall 1985 – spring 2016, the discrepancy could also be due to shifts in buyers tastes and demands. There is a possibility that the price effect of having a stamp or signature on a painting has changed over the time period.

Date of creation

If the artist has signed the date of creation on the painting, all else equal, the value impact would have been 26% in relation to a painting without a date as seen in Figure 7.⁷⁷

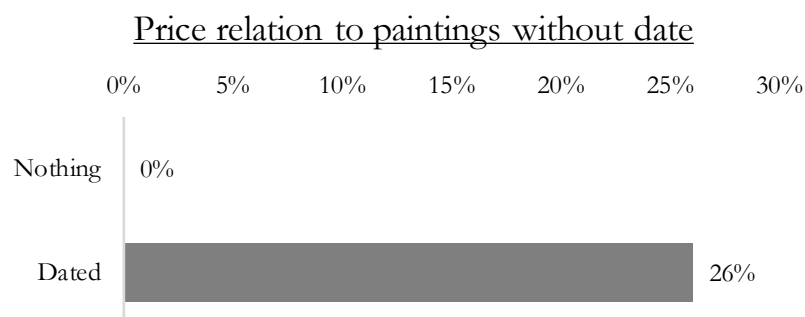


Figure 7

⁷⁷ Renneboog & Spaenjers (2013) found that a signature and date of creation increased painting value by 31% and 19%, respectively, on the international market.

4.2.4 Size

The painting with the largest size in our database is “Torghandel på Hötorget” by Pelle Åberg which is 202 cm in height and 513 cm in width and was sold in 2008 for 155,000 SEK. The two artists with the highest average surface area per painting are Carl Larsson (Total number⁷⁸: 54; Avg. Price: 605 KSEK) and Olle Baertling (Total number: 252; Avg. Price: 245 KSEK) with an average of 11,737 cm² and 10,730 cm², respectively. The average surface area in our database is 4,075 cm². Interestingly, both Anders Zorn and Bruno Liljefors, the artist with the highest average price and the artist with the highest number of paintings sold, have average surface areas above the overall average (5,386 cm² and 5,330 cm², respectively).



“Torghandel på Hötorget” by Pelle Åberg (1909-1964)

Our regression results indicate that for each 1% increase in surface area, the price of a painting increases with 0.54%. Furthermore, in the Partial regression, we are able to analyze the effects of height and width. The results are that for each 1% increase in height and width separately, the price increases with 0.58% and 0.45%, respectively. This indicates that higher paintings would yield a 13% premium in relation to wider ones, all else equal, which is in line with the previous study by Hodgson & Vorkink (2004). Additionally, the average height during this period was 55 cm² and the average width 63 cm².

The relationship between size and price is complex. Out of the top 50 paintings in terms of price (avg. price 5.4 MSEK), of which Anders Zorn represented 45, the average size is 8,148 cm².

⁷⁸ Total number of paintings sold

However, Docclo et al. (1994) concluded that the two ideal sizes of a painting were 2,320 cm² and 693 cm², which is quite different from the average size in our database and the average size of the top 50 most expensive paintings.

4.3 HPI and Share index

The following section includes three parts. The first part presents and explains the general development of the HPI and market for paintings in Sweden. The second section compares the development of the HPI in relation to a Swedish stock index. Lastly, the final section presents the quantified psychic returns in relation to a Swedish stock index including reinvested dividends.

The Complete regression which serves as a basis for the HPI resulted in an R² of 72.1% which is high in the context of HPI construction. Anderson & Björkman (2007) achieved an R² of 71.9%, Agnello (2002) and Higgs & Worthington (2005) achieved 64% and 68%, respectively.

4.3.1 Development of the HPI

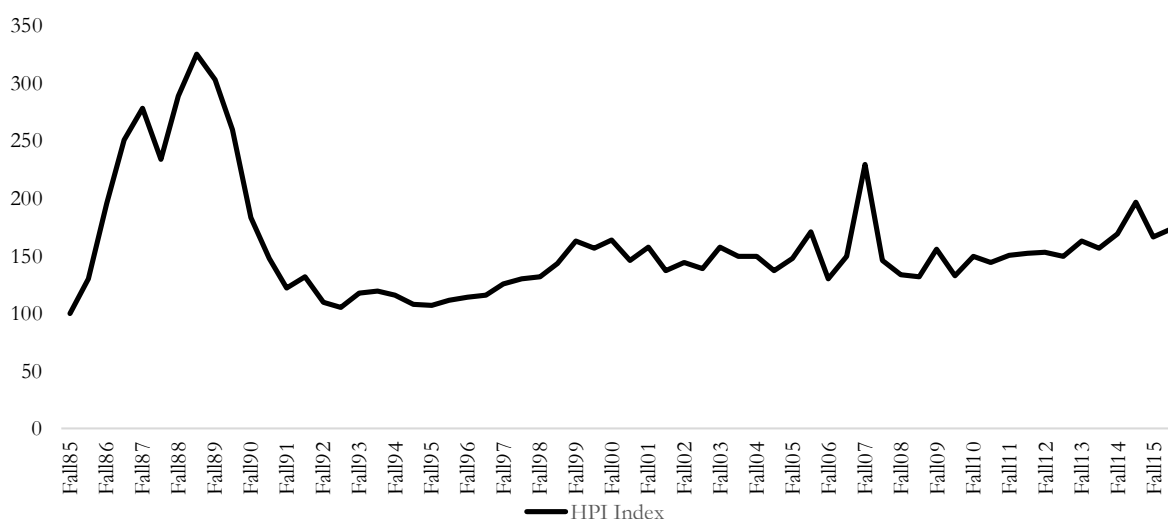


Figure 8

Figure 8 above shows the development of the HPI from the fall of 1985 until the spring of 2016. The peaks and troughs seem to coincide with general global and Swedish economic events. The significant growth from the fall of 1985 up until the peak of the fall 1988 is said to have been related to the Swedish financial crisis of 1990-1992.⁷⁹ Interestingly, as can be noted, the drastic peak in 2007 was also in conjunction with the latest global financial crisis.

During the period between 1980s and early 1990, the market for paintings increased dramatically. In fact, in Sweden, 140 paintings were sold for a value above 1 MSEK. Many art dealers were

⁷⁹ Article in Dagens Nyheter, June 11th 1993

generating turnovers of 300-500 MSEK and bidders were acquiring paintings and reselling them without even picking them up from the storage rooms of the auction houses. Later on, between 1990-1992, the very same art dealers saw their turnovers decrease to 20-30 MSEK per year and concurrently lost 70-80% of their customers. The overall turnover on the international market decreased by 50% and the turnover on the Swedish market decreased to 25% of previous levels. The bubble had burst and many of those 140 above 1 MSEK paintings were now being collected by banks and financial institutions as collateral.⁸⁰

During the 1980s, consortiums of buyers would form to acquire collections of art and paintings, many using debt as a primary source of capital.⁸¹ These collections were then offered to investors who could invest in so called art funds and thus own shares in collections of art. The art funds disappeared after the crash in the early 1990s, but were being mentioned again in the media around 2007. This highlighted the bubble tendencies of the time with lots of available and cheap capital being injected into the art markets yet again.⁸² When the market crashed in late 2007, at the same time as the global financial crisis started erupting, it did not show the same dramatic downfall as after the 1990s. Many art experts point to the migration to online auctions as a mitigating factor, allowing auction houses to net out the general market decrease with the ability to reach out to a wider customer base.⁸³

4.3.2 HPI returns in relation to the share returns

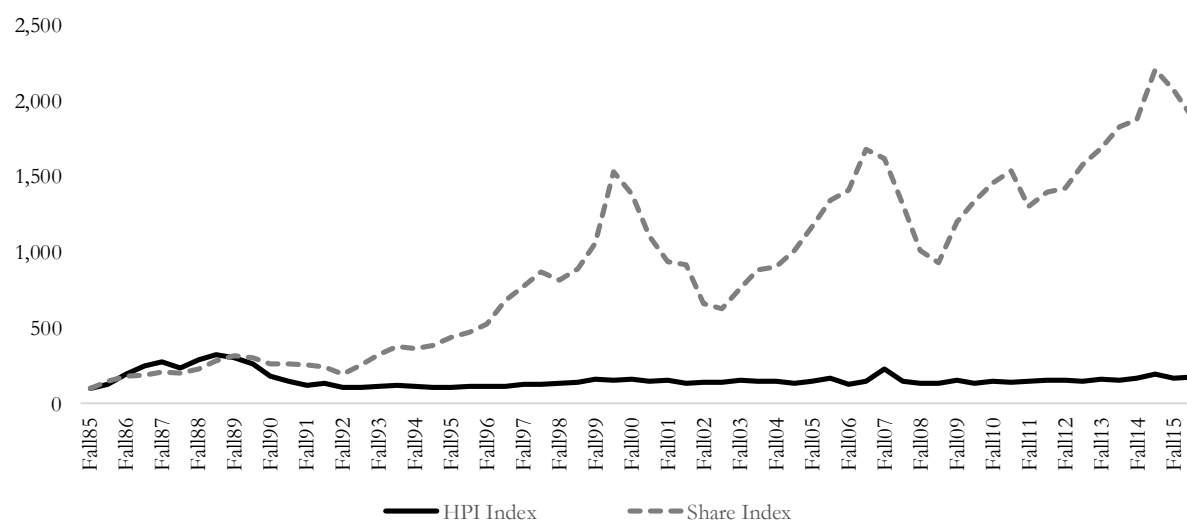


Figure 9

⁸⁰ Article in Dagens Nyheter, June 11th 1993

⁸¹ Anderson & Björkman (2007)

⁸² Article in Svenska Dagbladet, October 19th 2007

⁸³ Customer representative Helsingborgs Auktionsverk (2016)

Period	<i>Paintings</i>		<i>Shares</i>	
	Excl. Prov	Incl. Prov	Excl. Prov	Incl. Prov
85-96	1.0%	-2.6%	15.9%	15.9%
96-06	4.4%	0.5%	11.0%	11.0%
06-16	0.2%	-3.5%	4.0%	4.0%
85-16	1.8%	0.6%	10.3%	10.3%

Average percentage returns per annum without psychic returns and dividends

Table 11

As seen in Figure 9 and Table 11⁸⁴ the stock market has significantly outperformed the market for paintings in all the periods. A big portion of the difference between the returns is due to the high transaction costs associated with investing in paintings. Given purchase provisions of 22.5% and sale provision fees of 16.3%, an investor would have to see the value of their painting appreciate by 46.4% just in order to break-even on the investment. Transaction costs related to investing in shares are significantly lower (0.069%), with an insignificant impact on returns including transaction costs. The correlation between the returns of the HPI and the share index is 0.41⁸⁵ which indicates that there are some diversification benefits of adding paintings to a portfolio. Anderson & Björkman (2007) found a 0.21 correlation in their data. Our results indicate that the correlation has increased over time. However, as mentioned above, previous researchers have pointed to psychic returns as a potential explanatory factor for the difference in returns.

4.3.3 HPI including psychic returns

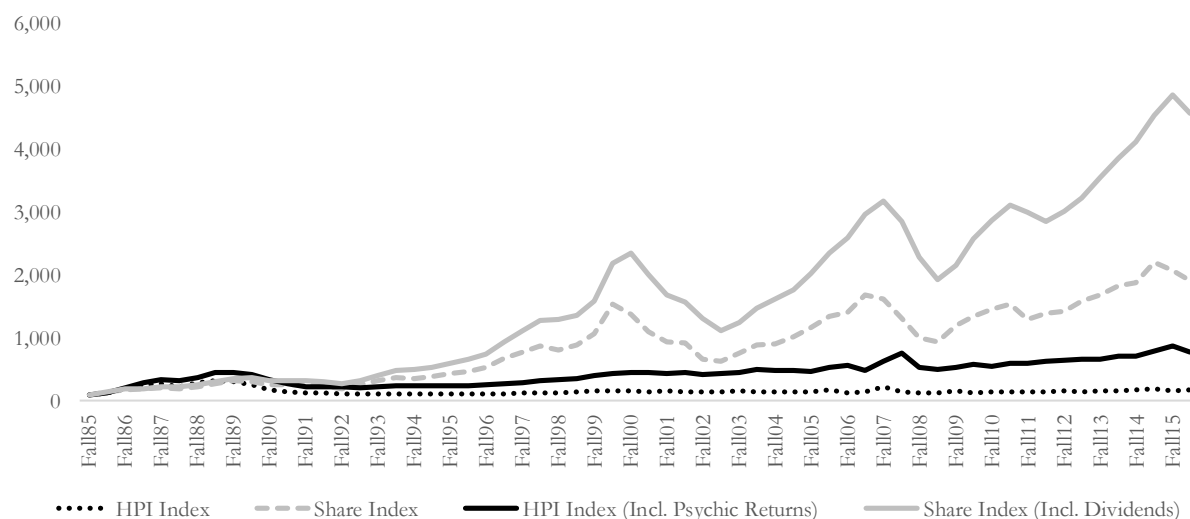


Figure 10

⁸⁴ The returns calculations are yearly geometrical averages. Please refer to Formula 12.

⁸⁵ Which is in line with previous research by Bryan (1985); Agnello (2002); Mei & Moses (2002); Fase (1996)

Period	<i>Paintings</i>		<i>Shares</i>	
	Excl. Prov	Incl. Prov	Excl. Prov	Incl. Prov
85-96	9.4%	5.5%	20.2%	20.2%
96-06	8.8%	4.8%	13.9%	13.8%
06-16	10.1%	6.0%	13.8%	13.8%
85-16	9.4%	8.1%	16.0%	16.0%

Average percentage returns per annum with psychic returns and dividends

Table 12

The addition of psychic returns does explain some of the difference in returns between investments in paintings and shares. With these returns included, an investment in paintings (including transaction costs) increases from a geometric average return per year of 0.6% to 8.1%. However, with the inclusion of reinvested dividends, the returns of the share index rise from 10.3% to 16% as well, thus the conclusion still remains that investments in shares are better from a returns perspective.

As mentioned, previous research also concluded that investments in paintings are not good from a financial point of view.⁸⁶ However, we have shown that the inclusion of psychic returns could yield considerable overall returns in theory. In fact, more recently, customers in the rental market for art are showing increasing interest in renting paintings. According to professional art expert Karolina Bertorp, more and more architects are contacting her in order to rent art for their clients. The increased interest is also driven by the flexibility of renting paintings as companies change offices more frequently today than they have done historically. This substantiates the commercial viability for an investor to actually purchase paintings in order to rent them out. We do however acknowledge the difference in simplicity and ease of investing in the stock market as opposed to the market for paintings.

As mentioned, the actual returns should be interpreted with caution. It is the level of psychic returns in relation to monetary returns that is of importance. These findings are illustrative of the fact that the only justifiable reason for investing in the market for paintings is out of pure love for art. Monetary returns only represent a minor portion of the overall returns which are mostly comprised of consumption benefits, or rather, psychic returns.

⁸⁶ Anderson (1974); Goetzmann (1993); Candela & Scorcu (1997); Hallius (1992)

5. Conclusions

The purpose of this thesis has been to identify the value drivers of Swedish high-quality paintings and to quantify the returns on investments in paintings over time in relation to the stock market. We have identified and analyzed four areas of interest. Firstly, by manually collecting data we have extended the dataset used by Anderson & Björkman (2007) and added 6,902 observations or 10 additional years of data, resulting in the largest Swedish database of high quality painting transactions. Secondly, by analyzing this dataset, we have been able to quantify characteristics that drive the value of paintings and to construct a Hedonic Price Index. By the use of our Complete and Partial regressions we have controlled for variables and assessed how much of the value is driven by the hedonic characteristics (artist, size, height, width, signature, date of creation and auction house). We also concluded that if we control for hedonic characteristics, all else equal, the sole fact that a painting is sold by Bukowskis increases its price by 17.6% in relation to Stockholms Auktionsverk⁸⁷. Moreover, we found that there seems to be a systematic underestimation of the prices set by the auction houses in relation to the actual prices paintings are sold for.

The market for paintings grew by 0.6% per year between 1985 and 2016, while the stock market grew by 10.3% over the same time period. The main part of this discrepancy was driven by the large transaction costs associated with investments in the market for paintings.

Previous research has identified psychic returns of paintings as another source of discrepancy. We have isolated the psychic returns by looking at the rental market for art and concluded that the total returns including both monetary gains and psychic returns amounted to 8.1% from 1985 to 2016. Again, given that stock market returns including reinvested dividends were 16% over the same time period, we have concluded that the only justification for investing in paintings is pure love of art. Monetary returns do not justify such investments, as the main part of the returns are comprised of psychic returns.

⁸⁷ Hence, on average, paintings sold by Stockholms Auktionsverk sell at a discount of 15% in relation to Bukowskis (as seen in Figure 4)

6. Suggestions for future research

This thesis has investigated paintings as an investment and built upon and extended the database of oil painting transactions collected by Anderson & Björkman (2007). In the process, we have come across a number of interesting suggestions for future research.

Gender perspective

One such research topic would be the implications of a gender perspective on art. Given the set of criteria we used to limit our sample (deceased Swedish artists with paintings that are put up for sale via traditional hammer auctions), women artists were very rare. In fact, our database only contains one female, Sigrid Hjertén (1885-1948). An interesting research topic would therefore be why the works of female artists of this era have been so rare in connection to traditional hammer auctions.

Buy-ins

Another topic of interest would be a thorough analysis of how buy-ins affect the valuation and turnover of paintings. Given the importance of the last sales price of a painting, which many appraisal experts use as an indicator of value, the failure of a painting to reach a specific price could be of interest. One way to investigate this topic would be to isolate paintings that have been bought-in at some point in time and then to track them to analyze whether a buy-in has had a lasting value effect. This has been done in another study on the US market⁸⁸ but would be of interest for Swedish paintings as well, especially given the strong increase of buy-ins at Swedish auctions during the last 30 years (that we mentioned in Section 4.1.2).

Masterpiece effect

Art dealers usually give the advice to their clients to buy the most expensive artworks they can afford, with the assumption that these will outperform the market. However, previous research on this so called masterpiece effect has resulted in mixed conclusions. A topic of interest would therefore be, do masterpieces actually generate higher returns over time in contrast to the rest of the market for paintings?

Psychic returns

Lastly, our attempt to capture and isolate the psychic returns of investing in art has opened up a wide range of other research topics. Many types of assets share similar characteristics in the sense

⁸⁸ Anderson et al. (2016)

that investors do not simply invest only with the goal of generating monetary returns. Rather, it is actually the consumption benefits (or psychic returns) that are the primary justification. Thus the suggestion is to further develop the theoretical base of psychic returns and to measure them for similar assets such as e.g. vintage cars, boats or other collectibles.

It is our pleasure to leave these suggested topics for a subsequent fourth master thesis on investments in high quality paintings at the Stockholm School of Economics.

7. List of abbreviations

Abbreviation	Explanation
AFGX	Affärsvärldens Generalindex, discontinued stock index for the Stockholm Stock Exchange
API	Average Price Index
avg	Average
B	Billion
c.	<i>circa</i> / around, about
e.g.	<i>exempli gratia</i> / for example
et al.	<i>et alii</i> / and others
etc.	et cetera
EUR	The currency unit of the European Monetary Union
Excl.	Excluding
HPI	Hedonic Price Index
Ibid	<i>Ibidem</i> / in the same place
i.e.	<i>id est</i> / that is
Incl.	Including
K	Thousand
M	Million
OECD	Organisation for Economic Co-operation and Development
OMXS60PI	The OMX Stockholm 60 PI index consists of the 60 largest and most traded shares listed on the NASDAQ OMX Stockholm Exchange <i>without</i> dividend reinvestments
OMXS60GI	The OMX Stockholm 60 GI index consists of the 60 largest and most traded shares listed on the NASDAQ OMX Stockholm Exchange <i>with</i> dividend reinvestments
RSR	Repeat-Sales Regression
SEK	Swedish krona, the currency of Sweden
TEFAF	The European Fine Art Fair
Total number	Total number of paintings sold
VAT	Value-Added Tax

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URL:

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9. Appendix

9.1 Artists in sample

Artist	Birth - Death	Average Price	Turnover
LILJEFORS, BRUNO	1860 - 1939	247,475	1,014
STOOPENDAAL, MOSSE	1901 - 1948	45,940	781
PERSON, RAGNAR	1905 - 1993	30,536	774
GRUNEWALD, ISAAC	1889 - 1946	161,574	757
NILSON, SEVERIN	1846 - 1918	37,654	714
OSSLUND, HELMER	1866 - 1938	59,351	696
EKSTRÖM, PER	1844 - 1935	65,612	662
KROUTHÉN, JOHAN	1858 - 1932	75,322	646
ERIXSON, SVEN	1899 - 1970	55,731	641
JOLIN, EINAR	1890 - 1976	53,164	637
SCHIÖLER, INGE	1908 - 1971	110,514	620
THORÉN, ESAIAS	1901 - 1981	28,557	603
LILJEFORS, LINDORM	1909 - 1985	25,438	568
SANDBERG, RAGNAR	1902 - 1972	155,080	558
SCHULTZBERG, ANSHELM	1862 - 1945	56,540	553
ÅBERG, PELLE	1909 - 1964	23,244	540
LUNDQUIST, EVERT	1904 - 1994	76,092	526
HJORTZBERG, OLLE	1872 - 1959	66,558	524
OLSON, AXEL	1899 - 1986	38,820	522
WALLNER, THURE	1888 - 1965	37,311	503
MÖRNER, STELLAN	1896 - 1979	29,495	492
VON GEGERFELT, WILHELM	1844 - 1920	41,027	479
HERMELIN, OLOF	1827 - 1913	26,230	441
JONSON, SVEN	1902 - 1981	45,275	440
OLSON, ERIK	1901 - 1986	56,102	410
SCHYL, JULES	1893 - 1977	13,611	408
ODELMARK, FRANS	1849 - 1937	24,196	385
BJURSTRÖM, TOR	1888 - 1966	22,150	370
LORENTZON, WALDEMAR	1899 - 1984	45,114	358
GENBERG, ANTON	1862 - 1939	27,040	350
KYLBERG, CARL	1878 - 1952	262,447	343
IVARSSON, IVAN	1900 - 1939	166,131	336
KALLSTENIUS, GOTTFRID	1861 - 1943	23,119	326
HAGBORG, AUGUST	1852 - 1921	55,381	316
WAHLBERG, ALFRED	1834 - 1906	41,399	312
WILHELMSON, CARL	1866 - 1928	160,484	310
JOHANSSON, CARL	1863 - 1944	23,963	307
NILSSON, AXEL	1889 - 1981	35,290	299
HALLSTRÖM, ERIC	1893 - 1946	35,920	294
HJERTÉN, SIGRID	1885 - 1948	404,329	280
KREUGER, NILS	1858 - 1930	94,150	279
AMELIN, ALBIN	1902 - 1975	61,610	273
OLSSON-HAGALUND, OLLE	1904 - 1972	243,938	272
ADRIAN-NILSSON, GÖSTA	1884 - 1965	309,613	266
ERICSON, JOHAN	1849 - 1925	33,721	262
FJAESTAD, GUSTAF	1868 - 1948	139,665	259
BAERTLING, OLLE	1911 - 1981	245,413	252
ZUHR, HUGO	1895 - 1971	16,258	240
ARBORELIUS, OLOF	1842 - 1915	26,071	218
PAULI, GEORG	1855 - 1935	45,985	213
NORDENBERG, BENGT	1822 - 1902	82,021	201
ZORN, ANDERS	1860 - 1920	2,103,287	195
TÖRNÄ, OSCAR	1842 - 1894	37,505	188
LARSON, MARCUS	1825 - 1864	73,506	172
LINNQVIST, HILDING	1891 - 1984	83,441	164
HOLMSTRÖM, TORA	1880 - 1967	10,577	148
BERGH, SVANTE	1885 - 1946	8,667	148
SIMONSSON, BIRGER	1883 - 1938	15,272	132
JOHANSSON, JOHAN	1879 - 1951	8,952	127
NORDSTRÖM, KARL	1855 - 1923	66,516	124
SIEGÅRD, PÅR	1877 - 1961	10,094	119
GÖRANSSON, ÅKE	1902 - 1942	117,365	111
THEGERSTRÖM, ROBERT	1857 - 1919	26,607	107
SJÖLANDER, WALDEMAR	1906 - 1988	7,989	94
JOHANSSON-THOR, EMIL	1889 - 1958	9,158	91
OLSON, WILGOT	1906 - 1990	6,225	89
SANDELS, GÖSTA	1887 - 1919	125,966	87
NORDGREN, AXEL	1828 - 1888	15,557	84

BIRGER, HUGO	1854 - 1887	102,323	79
SALMSON, HUGO	1843 - 1894	46,682	76
JERNBERG, AUGUST	1826 - 1896	35,444	72
JOSEPHSON, ERNST	1851 - 1906	146,048	63
ABBE, ALBERT	1889 - 1966	4,270	58
JANSSON, KNUT	1882 - 1966	6,708	56
LARSSON, CARL	1853 - 1919	605,528	54
IRWE, KNUT	1912 - 2002	10,419	54
ÖSTERLIND, ALLAN	1855 - 1938	12,117	53
PETTERSSON, OLLE	1905 - 1991	2,732	52
WALLANDER, WILHELM	1821 - 1888	58,996	50
FAGERLIN, FERDINAND	1825 - 1907	57,924	50
ULLMAN, SIGFRID	1886 - 1960	6,187	47
JANSSON, EUGENE	1862 - 1915	189,243	46
ANDER, TURE	1881 - 1959	15,459	37
ACKE, J.A.G	1859 - 1924	48,094	35
OLSSON, EMIL	1890 - 1964	4,777	32
D'UNKER, CARL	1828 - 1866	39,025	20
NORRMAN, HERMAN	1864 - 1906	53,782	17
JÖNSSON, ANDERS	1907 - n.a.	1,083	6

9.2 Auction houses in sample

Auction House	Average Price	Turnover	Average of Price / Estimate
BUKOWSKIS	148,422	8,059	125%
STOCKHOLMS AUKTIONSVERK	90,137	6,414	117%
UPPSALA AUKTIONSVERK	58,901	1,852	116%
BEIJERS AUKTIONER	121,269	1,749	131%
GÖTEBORGS AUKTIONSVERK	29,941	1,469	114%
NORDÉN AUKTIONER	105,254	1,413	114%
LILLA BUKOWSKIS	18,484	1,205	117%
FALKKLOOS AUKTIONER	22,510	766	114%
CRAFOORD	20,567	474	132%
AUKTIONSHUSET VON SCHÉELE	20,391	458	127%
SÖDERKÖPINGS AUKTIONSKAMMARE	48,111	395	108%
STOCKHOLMS AUKTIONSVERK, LILLA KVALITÉN	8,877	326	100%
NORRKÖPINGS AUKTIONSVERK	20,909	310	99%
BRUUN RASMUSSEN KONSTAUKTIONER	48,588	226	94%
HALMSTADS AUKTIONSKAMMARE	90,605	177	84%
VÅTTERBYGGDENS AUKTIONSKAMMARE	11,624	173	135%
MALMÖ KVALITETSUKTIONER	26,102	129	130%
ÖSTGÖTA ANTIK	77,243	121	105%
SKÅNES AUKTIONSVERK	17,166	94	118%
RUNFELDTS AUKTIONER	14,936	73	114%
HELSINGBORGS AUKTIONSVERK	14,992	24	92%
FORMSTAD AUKTIONER	8,425	4	67%

9.3 Regression results – Complete Regression (1985-2016) – SPSS Output

HPI
Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.849	0.721	0.719	0.676

ANOVA

Model	Sum of Squares	df	Mean Square	F	Sig.
1	Regression	30,407.8	171.0	177.82	.389.19
	Residual	11,785.8	25,795.0	.457	
	Total	42,193.6	25,966.0		

Model	Independent variables	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	7.46	0.06		125.07	0.00
	ABBE	-3.26	0.09	-0.12	-35.37	0.00
	ÅBERG	-1.68	0.03	-0.19	-48.51	0.00
	ÄCKE	-2.05	0.12	-0.06	-17.72	0.00
	ADRIAN	0.28	0.05	0.02	6.14	0.00
	AMELIN	-1.47	0.05	-0.12	-32.57	0.00
	ANDER	-2.39	0.11	-0.07	-21.10	0.00
	ARBORELIUS	-2.16	0.05	-0.15	-43.56	0.00
	BAERTLING	-0.62	0.05	-0.05	-12.96	0.00
	BERGH	-2.95	0.06	-0.17	-48.76	0.00
	BIRGER	-1.01	0.08	-0.04	-12.94	0.00
	BJURSTRÖM	-2.05	0.04	-0.19	-50.86	0.00
	DUNKER	-1.29	0.15	-0.03	-8.44	0.00
	EKSTRÖM	-1.40	0.03	-0.17	-43.28	0.00
	ERICSON	-1.69	0.05	-0.13	-36.89	0.00
	ERIXSON	-1.42	0.03	-0.17	-43.66	0.00
	FAGERLIN	-1.50	0.10	-0.05	-15.42	0.00
	FJÆSTAD	-0.96	0.05	-0.07	-20.78	0.00
	GENBERG	-2.12	0.04	-0.19	-51.94	0.00
	GÖRANSSON	-0.13	0.07	-0.01	-1.75	0.08
	GRUNEWALD	-0.46	0.03	-0.06	-15.11	0.00
	HAGBORG	-1.58	0.04	-0.14	-37.37	0.00
	HALLSTRÖM	-1.85	0.04	-0.15	-42.36	0.00
	HERMELIN	-1.78	0.04	-0.18	-47.65	0.00
	HJERTÉN	0.33	0.04	0.03	7.51	0.00
	HJORTZBERG	-1.27	0.03	-0.14	-36.29	0.00
	HOLMSTRÖM	-2.17	0.06	-0.13	-35.53	0.00
	IRWE	-2.71	0.10	-0.10	-28.51	0.00
	IVARSSON	-0.34	0.04	-0.03	-8.28	0.00
	JANSSON.E	-0.56	0.10	-0.02	-5.48	0.00
	JANSSON.K	-2.89	0.09	-0.11	-31.20	0.00
	JERNBERG	-1.56	0.08	-0.06	-19.01	0.00
	JOHANSSON.C	-2.01	0.04	-0.17	-46.69	0.00
	JOHANSSON.J	-2.62	0.06	-0.14	-40.62	0.00
	JOHANSSON.E	-2.80	0.07	-0.13	-37.68	0.00
	JOLIN	-1.43	0.03	-0.17	-43.74	0.00
	JONSON	-1.11	0.04	-0.11	-29.51	0.00
	JÖNSSON	-4.32	0.28	-0.05	-15.54	0.00
	JOSEPHSON	-0.14	0.09	-0.01	-1.62	0.10
	KALLSTENIUS	-2.37	0.04	-0.21	-56.22	0.00
	KREUGER	-0.83	0.04	-0.07	-18.71	0.00
KROUTHÉN	-1.17	0.03	-0.14	-35.85	0.00	
LARSON	-1.23	0.05	-0.08	-22.50	0.00	
LARSSON	0.56	0.09	0.02	5.93	0.00	
LILJEFORS.L	-1.89	0.03	-0.22	-55.25	0.00	
LINNQVIST	-1.21	0.06	-0.08	-21.52	0.00	
LORENTZON	-1.13	0.04	-0.10	-27.83	0.00	
LUNDQUIST	-1.04	0.04	-0.11	-29.46	0.00	
MÖRNER	-1.41	0.04	-0.15	-39.08	0.00	
NILSON	-1.61	0.03	-0.21	-50.90	0.00	
NILSSON	-1.76	0.04	-0.15	-40.55	0.00	
NORDENBERG	-0.99	0.05	-0.07	-19.42	0.00	
NORDGREN	-2.43	0.08	-0.11	-31.93	0.00	

NORDSTRÖM	-1.34	0.06	-0.07	-21.08	0.00
NORRMAN	-1.50	0.17	-0.03	-9.09	0.00
ODELMARK	-2.09	0.04	-0.20	-53.20	0.00
OLSON.A	-1.24	0.04	-0.14	-34.96	0.00
OLSON.E	-1.12	0.04	-0.11	-29.03	0.00
OLSON.W	-2.90	0.08	-0.13	-38.08	0.00
OLSSON	-3.21	0.12	-0.09	-26.29	0.00
OLSSON.O	0.22	0.05	0.02	4.91	0.00
OSSLUND	-1.14	0.03	-0.15	-35.90	0.00
ÖSTERLIND	-2.58	0.09	-0.09	-27.21	0.00
PAULI	-1.86	0.05	-0.13	-37.04	0.00
PERSON	-1.53	0.03	-0.20	-49.21	0.00
PETTERSSON	-3.67	0.10	-0.13	-37.69	0.00
SALMSON	-1.46	0.08	-0.06	-18.35	0.00
SANDBERG	-0.23	0.03	-0.03	-6.82	0.00
SANDELS	-0.90	0.07	-0.04	-12.02	0.00
SCHIÖLER	-0.37	0.03	-0.04	-11.10	0.00
SCHULTZBERG	-1.63	0.03	-0.18	-47.63	0.00
SCHYL	-2.33	0.04	-0.23	-58.60	0.00
SIEGÅRD	-2.45	0.07	-0.13	-37.06	0.00
SIMONSSON	-2.46	0.06	-0.14	-39.71	0.00
SJÖLANDER	-3.15	0.07	-0.15	-43.04	0.00
STOOPENDAAL	-1.47	0.03	-0.20	-48.11	0.00
THEGERSTRÖM	-2.15	0.07	-0.11	-31.53	0.00
THORÉN	-1.62	0.03	-0.19	-48.20	0.00
TÖRNÄ	-1.72	0.05	-0.11	-32.50	0.00
ULLMAN	-3.24	0.10	-0.11	-32.03	0.00
GEGERFELT	-1.64	0.04	-0.17	-45.55	0.00
WAHLBERG	-1.58	0.04	-0.13	-36.95	0.00
WALLANDER	-1.45	0.10	-0.05	-14.82	0.00
WALLNER	-1.58	0.04	-0.17	-44.32	0.00
WILHELMSON	-0.44	0.04	-0.04	-10.26	0.00
ZORN	1.84	0.05	0.12	35.44	0.00
ZUHR	-2.32	0.05	-0.17	-48.78	0.00
LNSize	0.55	0.01	0.38	100.16	0.00
Sign Verso	-0.17	0.04	-0.02	-4.72	0.00
SignStamp	-0.15	0.03	-0.02	-4.78	0.00
VonScheele	-0.48	0.03	-0.05	-14.20	0.00
Beijer	-0.09	0.02	-0.02	-4.27	0.00
Brasmussen	-0.18	0.05	-0.01	-3.81	0.00
Bukowskis.L	-0.78	0.02	-0.13	-35.58	0.00
Crafoord	-0.78	0.03	-0.08	-23.16	0.00
Falkkloos	-0.47	0.03	-0.06	-16.39	0.00
Formstad	-1.47	0.34	-0.01	-4.35	0.00
Göteborgs	-0.49	0.02	-0.09	-23.13	0.00
Halmstads	-0.13	0.05	-0.01	-2.49	0.01
Helsingborgs	-1.48	0.14	-0.04	-10.54	0.00
Malmö	-0.43	0.06	-0.02	-7.01	0.00
Metropol	-1.49	0.09	-0.05	-16.13	0.00
Norrköpings	-0.95	0.04	-0.08	-22.52	0.00
Östgöta	-0.11	0.06	-0.01	-1.69	0.09
Runfeldts	-0.65	0.08	-0.03	-8.07	0.00
Skånes	-1.12	0.07	-0.05	-15.19	0.00
Söderköpings	-0.14	0.04	-0.01	-3.79	0.00
Stockholms	-0.17	0.01	-0.06	-14.56	0.00
Stockholms.L	-0.86	0.04	-0.07	-21.85	0.00
Uppsala	-0.61	0.02	-0.12	-32.99	0.00
Vbygdens	-1.37	0.05	-0.09	-25.62	0.00
Spring86	0.03	0.05	0.00	0.67	0.50
Fall86	0.44	0.05	0.04	9.08	0.00
Spring87	0.69	0.05	0.07	14.36	0.00
Fall87	0.80	0.05	0.08	16.99	0.00
Spring88	0.62	0.05	0.06	12.67	0.00
Fall88	0.83	0.05	0.08	17.27	0.00
Spring89	0.95	0.05	0.09	19.81	0.00
Fall89	0.88	0.04	0.13	22.07	0.00
Spring90	0.73	0.04	0.10	17.47	0.00
Fall90	0.38	0.04	0.05	8.73	0.00
Spring91	0.16	0.06	0.01	2.70	0.01
Fall91	-0.03	0.05	0.00	-0.55	0.58
Spring92	0.05	0.05	0.00	0.92	0.36
Fall92	-0.14	0.05	-0.01	-2.59	0.01
Spring93	-0.18	0.05	-0.02	-3.78	0.00
Fall93	-0.07	0.05	-0.01	-1.43	0.15
Spring94	-0.05	0.04	-0.01	-1.07	0.28
Fall94	-0.08	0.04	-0.01	-1.91	0.06
Spring95	-0.15	0.04	-0.02	-3.37	0.00

Fall95	-0.16	0.04	-0.02	-3.52	0.00
Spring96	-0.12	0.05	-0.01	-2.59	0.01
Fall96	-0.10	0.04	-0.01	-2.17	0.03
Spring97	-0.08	0.05	-0.01	-1.76	0.08
Fall97	0.00	0.05	0.00	0.04	0.97
Spring98	0.03	0.05	0.00	0.73	0.47
Fall98	0.05	0.05	0.01	1.13	0.26
Spring99	0.13	0.04	0.01	2.91	0.00
Fall99	0.26	0.05	0.03	5.71	0.00
Spring00	0.22	0.04	0.03	4.97	0.00
Fall00	0.26	0.05	0.03	5.78	0.00
Spring01	0.15	0.05	0.02	3.28	0.00
Fall01	0.23	0.05	0.02	4.59	0.00
Spring02	0.09	0.05	0.01	1.84	0.07
Fall02	0.14	0.05	0.01	2.74	0.01
Spring03	0.10	0.05	0.01	2.10	0.04
Fall03	0.22	0.05	0.02	4.32	0.00
Spring04	0.18	0.05	0.02	3.55	0.00
Fall04	0.17	0.05	0.02	3.49	0.00
Spring05	0.09	0.05	0.01	1.77	0.08
Fall05	0.16	0.05	0.01	3.23	0.00
Spring06	0.31	0.05	0.03	6.24	0.00
Fall06	0.03	0.04	0.00	0.70	0.48
Spring07	0.18	0.05	0.02	3.56	0.00
Fall07	0.60	0.06	0.04	10.02	0.00
Spring08	0.15	0.05	0.02	3.27	0.00
Fall08	0.06	0.05	0.01	1.25	0.21
Spring09	0.05	0.05	0.00	1.03	0.30
Fall09	0.21	0.05	0.02	4.25	0.00
Spring10	0.05	0.05	0.01	1.10	0.27
Fall10	0.18	0.05	0.02	3.70	0.00
Spring11	0.14	0.05	0.01	2.85	0.00
Fall11	0.18	0.05	0.02	3.42	0.00
Spring12	0.20	0.05	0.02	3.87	0.00
Fall12	0.20	0.05	0.02	3.81	0.00
Spring13	0.18	0.05	0.01	3.25	0.00
Fall13	0.26	0.05	0.02	4.88	0.00
Spring14	0.22	0.05	0.02	4.41	0.00
Fall14	0.30	0.05	0.03	5.68	0.00
Spring15	0.45	0.06	0.03	8.02	0.00
Fall15	0.28	0.06	0.02	5.05	0.00
Spring16	0.33	0.05	0.03	6.08	0.00

a. Dependent Variable: LNPRICE1000

9.4 Regression result – Partial Regression (2006 – 2016) – SPSS Output

HPI
Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.836	.698	.694	0.7903

ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	10,931	115	.95	152	0.000
	Residual	4,719	7,556	0.625		
	Total	15,650	7,671			

Coefficients

Model	Independent variables	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	7.178	.110		65.203	0.000
	ABBE	-2.915	.216	-.087	-13.511	.000
	ÅBERG	-1.399	.068	-.150	-20.641	.000
	ACKE	-1.529	.325	-.030	-4.703	.000
	ADRIAN	.967	.085	.077	11.436	.000
	AMELIN	-1.413	.087	-.111	-16.294	.000
	ANDER	-2.484	.254	-.063	-9.785	.000

ARBORELIUS	-2.189	.104	-.140	-21.048	.000
BERGH	-2.923	.167	-.114	-17.512	.000
BIRGER	-.954	.171	-.036	-5.571	.000
BJURSTRÖM	-1.848	.100	-.124	-18.556	.000
DUNKER	-1.453	.282	-.033	-5.152	.000
EKSTRÖM	-1.560	.063	-.177	-24.631	.000
ERICSON	-1.848	.099	-.123	-18.656	.000
ERIXSON	-1.325	.060	-.156	-21.947	.000
FAGERLIN	-1.723	.200	-.055	-8.603	.000
FJAESTAD	-.534	.097	-.037	-5.508	.000
GEGERFELT	-1.659	.076	-.151	-21.930	.000
GENBERG	-2.217	.095	-.156	-23.327	.000
GRUNEWALD	-.194	.056	-.026	-3.484	.000
HAGBORG	-1.536	.095	-.108	-16.120	.000
HALLSTRÖM	-1.675	.094	-.118	-17.755	.000
HERMELIN	-1.752	.077	-.156	-22.898	.000
HJERTÉN	.846	.091	.062	9.268	.000
HJORTZBERG	-1.264	.066	-.135	-19.215	.000
HOLMSTRÖM	-1.391	.134	-.074	-10.361	.000
JANSSON.K	-2.963	.253	-.075	-11.731	.000
JERNBERG	-1.612	.200	-.051	-8.049	.000
JOHANSSON.C	-2.109	.103	-.135	-20.484	.000
JOHANSSON.E	-3.145	.223	-.091	-14.088	.000
JOHANSSON.J	-2.372	.126	-.134	-18.826	.000
JOLIN	-1.061	.058	-.133	-18.182	.000
JONSON	-1.074	.076	-.097	-14.148	.000
JOSEPHSON	.368	.162	.015	2.277	.023
KALLSTENIUS	-2.141	.101	-.140	-21.100	.000
KREUGER	-.533	.091	-.039	-5.882	.000
KROUTHÉN	-1.199	.061	-.141	-19.562	.000
KYLBERG	.357	.090	.027	3.981	.000
LARSON	-1.115	.098	-.075	-11.358	.000
LARSSON	.737	.159	.030	4.646	.000
LILJEFORS.L	-2.337	.080	-.204	-29.144	.000
LINNVIST	-.654	.103	-.043	-6.372	.000
LORENTZON	-.970	.080	-.081	-12.066	.000
LUNDQUIST	-.919	.066	-.104	-13.927	.000
MÖRNER	-1.296	.069	-.132	-18.797	.000
NILSON	-1.834	.072	-.182	-25.602	.000
NILSSON	-1.709	.107	-.105	-15.916	.000
NORDENBERG	-1.165	.105	-.072	-11.058	.000
NORDGREN	-2.525	.215	-.075	-11.759	.000
NORDSTRÖM	-1.361	.127	-.070	-10.687	.000
NORRMAN	-1.760	.326	-.034	-5.400	.000
OELMARK	-2.251	.092	-.167	-24.454	.000
OLSON.A	-1.138	.071	-.111	-16.036	.000
OLSON.E	-1.075	.077	-.096	-13.991	.000
OLSSON	-3.212	.327	-.063	-9.833	.000
OLSSON.O	.470	.087	.036	5.411	.000
OSSLUND	-.925	.054	-.132	-17.288	.000
ÖSTERLIND	-2.489	.241	-.066	-10.312	.000
PAULI	-1.285	.110	-.077	-11.716	.000
PERSON	-1.560	.067	-.182	-23.452	.000
SALMSON	-1.554	.184	-.054	-8.428	.000
SANDELS	-1.003	.172	-.038	-5.843	.000
SCHIÖLER	-.205	.064	-.023	-3.221	.001
SCHULTZBERG	-1.681	.072	-.160	-23.289	.000
SCHYL	-1.995	.098	-.141	-20.279	.000
SIEGÅRD	-2.362	.162	-.096	-14.598	.000
SIMONSSON	-2.083	.191	-.071	-10.907	.000
SJÖLANDER	-3.258	.304	-.069	-10.706	.000
STOOPENDAAL	-1.738	.069	-.176	-25.247	.000
THEGERSTRÖM	-1.863	.139	-.087	-13.397	.000
THORÉN	-1.343	.066	-.144	-20.325	.000
TÖRNÄ	-1.958	.120	-.107	-16.353	.000
ULLMAN	-2.530	.460	-.035	-5.506	.000

WAHLBERG	-1.582	.086	-.124	-18.462	.000
WALLANDER	-1.398	.184	-.049	-7.581	.000
WALLNER	-1.876	.080	-.161	-23.457	.000
WILHELMSON	-.090	.092	-.006	-.972	.331
ZORN	1.721	.110	.103	15.603	.000
ZUHR	-2.297	.150	-.100	-15.320	.000
Signed	.361	.046	.085	7.911	.000
Initial	.168	.086	.016	1.965	.049
Stamp	.231	.063	.037	3.663	.000
Verso	-.279	.084	-.022	-3.326	.001
Dated	.233	.022	.082	10.655	.000
LNHeight	.577	.035	.190	16.515	.000
LNWidth	.455	.035	.150	13.033	.000
Spring07	.150	.052	.023	2.860	.004
Fall07	.520	.065	.058	7.950	.000
Spring08	.133	.048	.024	2.770	.006
Fall08	-.001	.050	.000	-.011	.991
Spring09	-.007	.050	-.001	-.150	.881
Fall09	.177	.051	.029	3.469	.001
Spring10	.033	.050	.006	.664	.507
Fall10	.155	.050	.026	3.082	.002
Spring11	.054	.052	.009	1.055	.291
Fall11	.120	.055	.017	2.179	.029
Spring12	.124	.054	.019	2.298	.022
Fall12	.177	.055	.026	3.244	.001
Spring13	.133	.057	.018	2.329	.020
Fall13	.159	.057	.021	2.758	.006
Spring14	.097	.053	.015	1.829	.067
Fall14	.196	.056	.028	3.504	.000
Spring15	.335	.061	.042	5.528	.000
Fall15	.166	.059	.022	2.814	.005
Spring16	.168	.057	.024	2.951	.003
Bukowskis.L	-.835	.040	-.152	-20.693	.000
Crafoord	-1.052	.061	-.129	-17.331	.000
Formstad	-1.258	.269	-.030	-4.668	.000
Göteborgs	-.884	.113	-.054	-7.851	.000
Helsingborgs	-1.259	.159	-.051	-7.903	.000
Metropol	-1.294	.073	-.132	-17.761	.000
Norrköpings	-.758	.052	-.105	-14.623	.000
Skånes	-1.162	.084	-.102	-13.757	.000
Stockholms	-.100	.024	-.033	-4.178	.000
Uppsala	-.531	.028	-.141	-18.662	.000
Vbygdens	-1.287	.071	-.124	-18.190	.000

a. Dependent Variable: LNPRICE1000